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THE
LARYNGOSCOPE.

VOL. LXIII OCTOBER, 1953 No. 10

RHINOLOGY IN CHILDREN.
RESUME OF THE LITERATURE FOR 1952.

D. E. S. WISHART, M. D., J. B. WHALEY, M. D.,
and
W. B. WALLACE, M. D.,
Toronto, Canada.

As in the past year this resume has been prepared by three members of the Otolaryngology Staff of the Hospital for Sick Children, Toronto. It covers all the journals that have been reviewed in the past, and we have used the same classification and order as previously.

OF GENERAL INTEREST.

The Journal of the American Medical Association,[1] in an editorial states that after exerting a tremendous influence on the practice of medicine for a generation, the theory of focal infection in the past 10 or 15 years has fallen in part into disfavor. This has been partly due to the excesses and abuses that have been committed in its name and partly to the following observations that seem to discredit it: (*1*) Many patients with diseases presumably caused by foci of infection have not been relieved of their symptoms by removal of the foci; (*2*) many patients with these same systemic diseases have no evidence of infection; (*3*) foci of infection are, according to some statistical studies, as common in apparently healthy persons as in those with disease.

The observations just cited appear damning, but none of them actually disproves the theory that some foci of infection

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can in the presence of predisposing or accessory factors produce some systemic diseases. Arguments concerning the three observations are given and the conclusion reached that on iogical grounds alone the basic theory cannot be discarded.

In positive support of a modified theory of focal infection is the fact that certain foci are known to be capable of producing disseminated disease. Several instances are cited.

The fact that some foci participate in the production of some diseases does not, however, justify the assumption that all foci produce disease or that all poorly understood diseases are due to foci of infection. It is well established that removal of foci in patients with advanced rheumatoid arthritis is not a curative procedure.

In view of the demonstrated importance of foci of infection in some diseases and the still valid theoretical possibility that they contribute to the production of others, it is apparent that focal infection cannot be ignored in the practice of medicine; on the other hand, the indiscriminate removal of all suspected or potential foci from a person without complaints is to be condemned.

It is suggested that the primary focus should be eradicated promptly by chemical and/or surgical treatment and that the secondary disease, if due to active infection, should be treated similarly. The prevention of secondary disease in susceptible persons is even more important than a direct attack on an infected focus. The administration of antibiotics or sulphonamides to patients with rheumatic heart disease during seasons when respiratory infections are prevalent is now accepted practice for the prevention of recurrent attacks of rheumatic carditis, as is the use of these drugs in patients with valvular or congenital heart disease to prevent bacteraemia during and after removal of infected teeth or tonsils.

SINUSITIS.

F. J. Birrell,[2] of Edinburgh, reviewed the British literature on chronic sinusitis in children and made some very interesting comments. He then followed up with some of his own

observations. Previous papers on the subject showed a high incidence of chronic maxillary sinusitis in children investigated by proof puncture. This led the writer to ask these questions. First,—how does chronic sinusitis arise? In adults it usually follows acute sinusitis, but in children acute maxillary sinusitis is rare. Might it not be that chronic sinsitis is not as common as one is led to believe?

Second,—the maxillary sinuses, in common with other sinuses, are in a state of active development during childhood. If there is chronic infection present why is there no evidence of eruption of unhealthy teeth, or arrest of the development of the maxillary air sinus such as occurs in the mastoid cells when these have been associated with otitis media in infancy and early childhood?

Third,—if such great percentages of children in the last 20 to 30 years required energetic surgical correction, what happened to sinus infections in children before this? Obviously it had not been a very common condition.

The writer's impression in the operating-room was that chronic maxillary sinusitis in children was uncommon as shown by 240 proof punctures over a period of three to four years, so he analyzed his findings.

The ratio of boys to girls was two to one. All the children were under 12 years of age and the greatest number was in the six to eight years group. The predominating symptoms encountered were,—nasal discharge, frequent colds, nasal obstruction or mouth breathing, persistent cough, bronchitis, bronchiectasis, headache, asthma, discharging ears and deafness.

Examination of the nose gave a variety of findings. These signs were a clear nose, congested nose, allergic type of nose, mucoid, muco-purulent, purulent or unspecified nasal discharge, crusting and deflected septum. Half the cases had their tonsils and adenoids removed.

Positive X-ray findings were present in every case subjected

to proof puncture, and no case was labelled sinusitis until a radiograph revealed either thickened mucosa or opacity of the antrum.

The technique carried out was to puncture the antrum with a Lichwitz trocar and cannula and then sterile saline solution was injected from a syringe carrying a blunt-pointed needle inserted through the cannula. The solution was then re-aspirated into the syringe and examined microscopically for pus or muco-pus. The antrum was then lavaged in the positive cases.

Forty-three cases showed pus or muco-pus. Of these all but four cleared on a second antrum washout. Two of these cleared on further puncture, leaving only two which required intranasal drainage. Only these two could be said to have suffered from irreversible chronic maxillary sinusitis, a percentage of 0.53 per cent of the total number of antra investigated.

These findings do not agree with those of other investigators, and the writer of this article feels that chronic maxillary sinusitis is not as common as we think. He believes that ventilation in the nose is an important factor in restoring to normal the membranous lining of the maxillary sinus. The removal of tonsils and adenoids is a factor here, as is also the shrinking of the lymphoid tissue at puberty; so, treatment should be directed in the first instance towards re-establishing nasal respiration rather than against a non-existent sinus infection.

Capps[3] believes it should be possible to attack infections of the maxillary antrum in children while it is in the stage of physiological response and before irreversible pathological change has taken place. He has found established sinus disease in a very small number of children between one and ten years of age. Replacement therapy may help, but he believes it can be overdone and that regular postural treatment at home will accomplish as much and more. If medicinal measures fail, puncture and aspiration or lavage is advisable but only in hospital under general anesthesia.

Huggill and Ballantyne,[4] from 109 children referred to their clinic for investigation, selected for study 55 with the combined lesions of adenoids and sinusitis. The children suffered from recurrent colds and nasal obstruction. The authors summarize their findings and conclusions as follows:

Adenoids were present in nine out of every ten children who complained of mouth breathing and snoring. When posterior rhinoscopy or digital examination of the nasopharynx is impossible, a lateral soft tissue X-ray of the nasopharynx may be of considerable assistance in diagnosing the presence of adenoids.

If in the combined presence of adenoids and antral infection the antra only were treated, no more than one-half of the cases became symptom-free and these only when the adenoids were small. Such a successful result was never seen when the adenoids were large; however, when the adenoids were removed either alone or in conjunction with antral lavage, a wholly satisfactory outcome occurred in more than three-quarters of all the cases so treated. They recommend that the adenoids be removed in all cases when they are present.

It remains doubtful whether the antra should always be treated at the same time when there is evidence of infection therein. Seventy-five per cent of the cases in which the adenoids and antra were both treated were symptom-free when last seen, but no fewer than 82 per cent of the cases in which the adenoids only were treated were also cured; hence they feel that it is justifiable to remove the adenoids alone in the first instance and to treat the antra if symptons persist for a period of three to six months after operation.

Since the correlation of radiological appearance and antral lavage was not entirely satisfactory other criteria of infection are desirable. Ninety per cent of all children who complained of a thick nasal discharge or in whom pus or muco-pus was present on anterior rhinoscopy showed evidence of infection on washout. They suggest, therefore, that should such symptoms or signs persist after removal of the adenoids, antral

washout should then be performed and the antrum be treated by repeated lavage through an indwelling plastic tube.

Goldman[5] advocates the use of cytological and bacterial studies in sinus disease. He points out that the problem in most cases is the differentiation of infectious from non-infectious disorders of the nose and sinuses; vasomotor rhinitis and sinusitis can often be indistinguishable especially in children. Antral lavage in a case of uncomplicated vasomotor rhinitis may give secretion which may be indistinguishable from the returns found in infectious cases. Microscopic study of spreads of material from the nose and sinuses as well as cultural studies of these same specimens provides data which can be very helpful in differentiating infectious from non-infectious diseases of the nose and sinuses. For instance, the microscopic examination of a spread will indicate the amount and character of the mucous, the character of the cells and number and types of micro-organisms. A moderately large number of eosinophiles suggests allergic or vasomotor rhinitis. Large numbers of white blood cells and micro-organisms in quantity indicate infection. In the same way cultures are helpful because certain bacteria are not normally found in nasal secretions, and their presence is indicative of infection. Pneumococci, Hemolytic Streptococci, Streptococcus viridans and Staphylococcus aureus A in large numbers, Hemophilus influenzae and usually para-influenzae and Klebsiella pneumonia are very rarely found in the normal nose or sinus and their presence strongly suggests infection. On the other hand, Staphylococcus albus, B. Neisseria species, diphtheroids and usually Staphylococcus albus A. and Staphylococcus A and B in small numbers are present in the normal nose and are not associated with infection.

He recommends sensitivity tests on the recovered organisms as a guide to treatment with antibiotics.

Shahinian[6] states that surgical treatment of the maxillary sinuses is not often necessary. In 2500 of his patients with symptoms referable to the nose and sinuses only 35 had chronic purulent maxillary sinusitis with drainage defect, an incidence of between one and two per cent. He restricts this

diagnosis to cases that continue to have true pus in the wash returns of antrum irrigations at repeated adequately spaced intervals. Cultures and antibiotic sensitivity tests should be done first and then a thorough trial of combined irrigation therapy and appropriate chemotherapy. If complete cure is not obtained he advises surgery.

He stresses the remarkable recuperative capacity of sinus mucosa and advises the sublabial approach without removing the antral mucosa *in toto*. He interferes with the mucous membrane only to the extent of removing polyps or taking tissue for biopsy. When making the antra nasal window he recommends an opening 1 cm. or more in diameter through the thin bone and describes in detail submucosal removal of the bone so that antral and nasal mucosal flaps can readily come together. The lower margin of the window should not be too close to the floor of the nose, because there the bone is too thick to allow accurate performance of the sub-mucous procedure.

His article is worth reading in detail. It explains how total removal of antral mucosa may lead to unhappy results due to extensive formation of fibrous tissue bands and defective regeneration of epithelium.

Pang[7] has reviewed the literature on air embolism during antral lavage and has reported on two cases.

This is a terrifying complication of what should be a completely safe procedure. Fifty-eight cases had been collected with a mortality rate of 39.5 per cent. The clinical picture is one of sudden collapse into unconsciousness.

In all cases there is no doubt that the air gets into the circulation during puncture. A vessel becomes injured, and air is forced directly into the blood stream. Air embolism has occurred through puncture through both the inferior and middle meatus and as well when irrigation was done through the natural ostium. The most important fact is that air embolism always follows and never precedes air insufflation, and the only sure way of preventing this complication is to

discontinue entirely the insufflation of air into the maxillary sinuses—a procedure which is not only unnecessary but also is exceedingly dangerous.

Macbeth[8] states that the course and prognosis of osteomyelitis of the maxilla have been radically changed from grave to benign since the advent of antibiotics. Operative injury or direct infection from the teeth or antrum are the commonest etiological factors. Infection is more likely to gain a footing and to spread in the spongy alveolar mass than in the relatively compact bone which forms the wall of the antrum. The arterial supply is derived from the internal maxillary artery whose branches form anastomising loops or arcades, consequently sequestra are likely to be limited or to invade the whole bone. In fulminating cases the infection may spread to neighboring bones—orbital cellulitis and cavernous thrombosis are due to direct spread. Cases may resolve often with sequestration. If they remain untreated the disease may spread to other bones.

In sucklings the disease is an acute infection of staphylococcal origin spreading probably from a germ of a first molar tooth. Infection may proceed from a mother's breast, an attendant's fingers, or a feeding bottle. Swelling of the face and lower eyelid are usual. Infection of the antrum is secondary only.

Treatment consists of penicillin and draining the pus, then removing the sequestra.

Six typical cases are described and illustrated. Three were in children.

The above paper was given before the Section of Laryngology of the Royal Society of Medicine and was followed by lengthy discussion. Mr. E. D. D. Davis said the osteomyelitis of the maxilla in the infant was rare and that in 1905 Brown Kelly collected only 17 reported cases. He himself had seen only five. It was universally accepted that this type of osteomyelitis commenced in the tooth follicle; it very rarely, if ever, started in the antrum. If suppuration was present a crucial incision down to the bone with a sharp knife should

be made. A gauze drain or packing was unnecessary and undesirable. Mr. Gavin Young deprecated that "infernal instrument" the rasp. He himself had never used it, but he had seen cases following the use of the rasp.

Thompson, Clark and Simons[9] describe in detail the clinical course of two cases of osteomyelitis of the skull complicating acute frontal sinusitis which recovered. The patients were boys of 11 and 17 years of age. In both cases there was extensive edema of the entire scalp except the occiput, the antra were full of pus and the frontal sinus contained pus, the floor of the affected frontal sinus was trephined, and a blood-count on the day of admission was within normal limits. In the eleven-year-old boy radiography revealed an apparently clear frontal sinus, yet the sinus was found full of pus under pressure.

Twelve months later there was no recurrence, and the authors acknowledge that the patients may still develop sequelae. They consider it clear that these patients were nursed through a very critical period and that the amount of bone work necessary in the future to deal with any residual infection is likely to be confined to a limited and circumscribed area.

They suggest that osteomyelitis of the skull complicating frontal sinusitis should be treated on the following lines:

1. Nasal swab and culture. Identification of the responsible organism and its sensitivity to the antibiotics and sulphonamides.

2. The effective antibiotic should be given in large doses.

3. Early drainage of the responsible sinuses if ordinary drainage is inadequate. Any surgical interference, however, should be as conservative as possible. Trephining of the floor of the frontal sinus allows inspection of the interior of the sinus and of its posterior wall.

4. Vasoconstrictors intranasally, the maintenance of an adequate nasal airway, and repeated antral washouts, all with the object of aiding sinus drainage and restoring the normal physiological processes.

They consider that *residual* disease can be dealt with at leisure after the acute phase has subsided.

Comment: Study of the story of osteomyelitis complicating acute frontal sinusitis as exemplified over many years in the resume of rhinology in children shows conclusively that the favorable prognosis of today is due almost entirely to adequate dosage of penicillin long maintained. It will also show that on this side of the Atlantic we favor higher doses of penicillin and at operation a minute drainage opening in the floor of the frontal sinus taking care to avoid damaging the naso-frontal duct.

William Reid Pitts[10] presents and discusses four successive cases of acute subdural abscess complicating suppurative frontal sinusitis.

In acute suppurative frontal sinusitis followed by orbital swelling, persistent headache, malaise, fever, at times with chills, meningeal signs and lethargy, the presence of subdural abscess should be suspected. The sudden onset of Jacksonian convulsions and hemiplegia with aphasia usually make the diagnosis almost certain.

The abscess is usually limited to one side at the beginning and occurs either by direct extension or indirectly by spreading thrombophlebitis—if undrained the abscess spreads over the entire cerebral hemisphere and later to the opposite side.

Early diagnosis and treatment are essential to prevent fatal termination.

Treatment consists of massive antibiotic therapy and immediate evacuation of pus through strategically placed burr holes plus instillation of penicillin into the subdural cavity. Bilateral exploration is important. Unfortunately convulsive seizures are all too often a serious sequela.

CONGENITAL ABNORMALITIES.

Cohen and Mitchell[11] report a case of bilateral congenital choanal atresia in a new-born and point out its similarity to

asphyxia neonatorum. Their patient was cyanotic shortly after birth and the respirations were rapid and irregular. When the child cried his color again became good.

Catheters were passed into the nose but not through into the pharynx. A silver protein solution instilled into the nasal cavities did not show in the throat. Iodized oil was then placed in both nasal cavities and roentgenography was done. This showed complete obstruction in the posterior choanae.

The cyanotic spells became more frequent and more severe, so a tracheotomy was performed. The baby died 36 hours later, the cause of death being bronchitis and pneumothorax.

The authors point out that choanal atresia may be unilateral or bilateral, and the former is commoner and much less serious. The simplest means of diagnosis is to pass an infant sized rubber nasal catheter through each nostril into the nasopharynx to test for patency.

Treatment of the unilateral type may be deferred until the child is older, but bilateral choanal atresia usually requires early surgical repair, particularly if the symptoms are severe.

It is suggested that a more thorough autopsy examination in cases of asphyxia of the new-born might reveal undiagnosed cases of choanal atresia.

Walker, Moore and Simpson[12] have reported on intranasal encephaloceles especially with respect to the diagnostic signs and proper treatment. Intranasal encephaloceles comprise about ten per cent of the congenital hernias of the cranium. They occupy the nasopharyngeal cavity and communicate with intracranial structures through the lamina cribrosa.

The diagnosis is not difficult if the lesion is kept in mind. Any nasal tumor in a new-born or a child is apt to be an encephalocele since polyps and neoplasms are rare in children. The mass may protrude from one nostril and hang down into the pharynx. The pedicle always leads to the superior limit of the nasal sulcus. It is soft and compressible and may weep cerebrospinal fluid. The root of the nose may be distended by the intranasal mass. Aspiration is hazardous because of the

risk of meningitis. X-rays rarely show any defect in the cribriform region. Intranasal encephaloceles are associated with a high mortality rate mainly due to failure to recognize the lesion and the performance of ill advised intranasal aspiration, biopsy or surgery.

This mortality rate can be reduced to a minimum by correct diagnosis and repair via the intracranial route by neurosurgery. Any persisting nasal obstruction may be corrected after, and only after, the cerebrospinal fluid spaces have been well sealed off from above. Adequate chemotherapy, pre and post operatively renders the operative procedures relatively safe and simple.

Paul M. Moore[13] has reviewed the literature on intranasal encephalomeningoceles and has reported one case. He stresses that the diagnosis should be established before any operative procedure or biopsy is done and points out diagnostic features—*a*) abnormal width between the eyes, *b*) cystic polyoid mass in the nose with attachment between the middle turbinate and septum or to the septum and anterior walls of the nasal cavity, *c*) these lesions are present from birth. X-ray evidence of bony cranial defect is seldom seen. Brain pulsations and increase in size on crying are also not seen.

Moore advocates intracranial repair of the bony dehiscence combined with intranasal removal of the herniated mass.

The Journal of the American Medical Association[14] replies to a request for information regarding "nose drops" as follows:

Although nasal vasoconstrictors are not curative, they provide symptomatic relief and are among the more important drugs available to physicians for use in the nasal cavity on a rational physiologic basis. Ephedrine is the most widely used. Its successful application has led to the synthesis of other nasal vasoconstrictors, some more potent and others less so than ephedrine.

Nasal vasoconstrictors serve various useful purposes. They provide temporary relief from the discomfiture of intranasal

obstruction, improve nasal ventilation, frequently promote adequate drainage from infected paranasal sinuses by opening obstructed ostia; make the nasal cavity more visible for inspection and diminish mild nasal epistaxis. Nontoxic nasal vasoconstrictors that are compatible with ciliary motility, that do not vary greatly in their hydrogen ion concentration from that of normal nasal secretions (p^H 5.5 to 6.5), and that are non-traumatizing to the mucous membranes are most useful in the treatment of the nasal cavity and the paranasal sinuses and should be for these cardinal attributes.

Excessive and careless use of sympathomimetic amines for prolonged periods may lead to a clinical syndrome in which the dominant complaint is nasal stuffiness. Fortunately, nasal sensitivity to vasoconstrictors can be rapidly checked by discontinuing the medicament. Therapeutic nihilism with regard to nose drops is as bad as overtreatment. Much depends on the ability of the physician to guide his patients in the proper use and selection of nasal medicaments.

DRUGS.

Mitchell[15] contributes a short clear statement regarding the clinical use and abuse of antihistamines. He summarizes his article thus: from a straight antihistaminic point of view these drugs have accomplished less than was hoped for; they have proved of value in certain conditions where the pharmacological mechanism is unknown; and finally their widespread use creates additional problems arising through certain side-effects of the drugs,—those relating especially to drowsiness and incoordination.

Antihistamines, in certain instances, have been extensively promoted through the lay press and the radio, for the control, or suppression, of such familiar conditions as hay-fever or the common cold, where little serious ill-result would likely follow self-medication. Because of this general attitude he stresses the principal disadvantage in the use of antihistamines. This lies in their side-effects which in approximate order of importance are:—*1.* drowsiness, ranging from actual sleepiness to impairment of power of concentration; *2.* sensa-

tion of dryness of the throat; *3.* muscular incoordination; *4.* visual effects, probably due to impairment of accommodation; *5.* certain antihistamines have been shown to increase the severity and frequency of epileptic seizures in epilepsy of focal or idiopathic origin.

In considering the harmful effects of these drugs one is concerned, not so much with the extremely rare deaths due to overdosage or agranulocytosis, as with the effect of these drugs upon our industrial population and those who drive their own vehicles in traffic.

Williams[16] states that the first rush of enthusiasm for the use of cortisone and corticotropin resulted in their indiscriminate and haphazard use in medicine. Since then we have been allowed to assess the results, and they have generally been disappointing in the field of otorhinology and laryngology.

These drugs have many unfavorable effects—Euphoria is especially frequent and may amount to acute mania. In some instances the reported good results may have been to a large extent influenced by the production of euphoria. Diabetes may be aggravated by these drugs. Facial appearance may be altered giving rise to a Cushing-like effect. Disturbances of water and electrolytic metabolism can also occur especially with corticotropin. Above all there is an increase in the danger of infection during prolonged therapy with either drug.

Against these unfavorable effects there are few otorhinologic conditions which warrant the risk entailed. Nasal polyposis may show temporary improvement, but the improvement is of short duration, and the older established methods of treatment are much to be preferred.

The one great exception was the use of cortisone and corticotropin in idiopathic (lethal) granuloma. In this disease these hormones offer the only hope of saving the patient's life and seem to produce a definite healing tendency in these lesions.

Wall and Shure[17] have injected cortisone intranasally into the inferior turbinates in a series of verified allergic rhinitis patients and as well in patients with vasomotor rhinitis where no allergen could be demonstrated. They used 2.5 to 25.0 mg. of cortisone in suspension. The smaller doses were adopted after two severe anaphylactic-like reactions were encountered with the larger amounts. A good response was obtained in the true allergic cases—80 per cent were relieved for from six weeks to ten months. Only one of 13 patients with vasomotor rhinitis was helped.

Wall and Shure advocate this method for treatment of allergic rhinitis especially of the seasonal variety, but it should again be noted that there were two severe immediate constitutional reactions in two of 65 patients treated.

McCurdy and Neter[18] report observations on the emergence of a gram-negative, bacillary, respiratory flora in infants treated with either penicillin alone or penicillin and a broad-spectrum antibiotic, or a broad-spectrum antibiotic alone.

Their study was carried out on infants under two years of age suffering from respiratory infections and other diseases. Nasopharygeal and throat cultures were taken prior to, concomitant with, and subsequent to, antibiotic therapy. They studied 107 infants of whom 12 received penicillin alone, 22 were treated with penicillin as well as a broad-spectrum antibiotic (Aureomycin, chloromycetin or terramycin) and 21 patients received one of the broad-spectrum antibiotics. Fifty-two infants served as controls and these did not receive antibiotic therapy.

The emergence of a gram-negative bacillary flora in the culture taken occurred in four out of the 12 patients treated with penicillin alone, 15 out of the 22 treated with penicillin and a broad-spectrum antibiotic and in only four out of the 21 infants who received a broad-spectrum antibiotic exclusively.

The authors conclude from their study that in infants the use of penicillin in conjunction with a broad-spectrum anti-

biotic is followed rather frequently by the emergence in the upper respiratory tract of a predominant gram-negative, bacillary, aerobic flora. This occurs much less frequently after the use of a broad-spectrum antibiotic alone.

It is the practice of some physicians to instruct mothers to administer tablets and capsules to infants by pushing them far back over the tongue into the hypopharynx. Emerson and Bradford[19] report the inhalation of a capsule of Aureomycin as a result of this form of administration.

The baby was nine months old and when the capsule was not taken in orange juice the mother pushed the capsule over the tongue with her finger. The patient suddenly choked, coughed and became cyanotic. Later he seemed all right except for wheezing. It was realized that aspiration had taken place and a bronochoscopic examination was carried out. The mucosa of the bronchi was red and swollen. As much aureomycin as possible was sucked out, the capsule having broken up previously, and no real damage persisted.

A plea is put forward for care when instructing mothers of infants in the art of medication. It is suggested that when other methods of administration of drugs are available, tablets and capsules should not be given by the oral route.

ALLERGY.

Marvin Jones[20] felt there was need for continually alerting otolaryngologists to the frequency of allergic symptoms in our specialty.

He pointed out that repeated radical operations on the sinuses prevalent in the past produced less than satisfactory results. He also observed that non-surgical treatment in allergic patients also failed and was of the opinion that a combination of these methods is likely to give the best results.

The following general program is proposed:

I) Daily physical outdoor exercise

II) Establishment of a controlled emotional balance in proportional living

III) Adjustment of damaging irregular living habits

IV) Elimination of contacts with known allergic irritants

V) Desensitization to dusts and molds and to histamine

VI) Selection of a nutritionally complete allergen-low diet for seasonal allergies

VII) Application of skin tests with appropriate treatment

VIII) Administration of antihistamines for treatment and diagnosis when indicated

IX) Correction of organic irregularities

X) Doing the necessary surgery in carefully selected cases

Jones observed that frequently there will be a therapeutic effect from small injections such as test skin doses and emphasizes that treatment should be stopped as soon as definite improvement is evident. He advocated a series of treatments of not longer than three weeks, because he felt long term treatments defeat our purpose in this matter by allowing the entry of foreign protein which will cause the very thing that one is trying to cure. This undesirable result occurs frequently and especially when the larger doses are used.

The paper deals briefly with allergen low diets and explains how other foods may be added with caution after the patient has been symptom free for six weeks. If a particular food causes a relapse after two trials the offending food is removed from the diet. This method attempts to detect offending foods through clinical trial and a year or more may pass before a tolerated diet can be finally selected. The final results in restored health on a permanent basis have been most gratifying.

The paper concludes with a presentation of five cases which over many years had received either surgical or antiallergic care alone without results but which obtained symptomatic cure by combined polypectomy and antiallergic treatments.

Louis E. Silcox[21] believes that hyperplastic sinusitis is primarily a bacterial infection and that the hyperplastic changes are the result of sensitivity to the bacterial allergens.

This bacterial allergy is best treated by the use of autogenous vaccines plus appropriate surgical measures when the hyperplastic changes are considered to be irreversible.

In his series of 200 cases—36 per cent were deemed irreversible, and surgical intervention was advised in addition to the autogenous vaccine.

He describes his methods of preparation and administration of the vaccine and points out that autogenous vaccines are as individual as one's personality and that treatment with them must be empirical. His patients' ages ranged from ten months to 74 years and the average period of treatment was ten months. 170 were improved or markedly improved, 26 were not improved and four were made worse by this treatment.

Autogenous vaccine therapy is presented as a potent agent in the management of hyperplastic sinusitis.

Childrey[22] reports on 900 cases of allergic affections of the nose and sinuses treated by submucosal injections of five per cent Sodium Psylliate intranasally. The average age of the group was 32.2 years—9.4 per cent were under ten years of age.

The solution was injected into areas of mucosa which were swollen and irritated. Principally the inferior turbinates were treated although the middle turbinates and areas on the septum were injected as well.

The solution is mixed with one to four per cent procaine to minimize post treatment discomfort.

Following treatment some relief is to be expected in two or three weeks, and within a few months the mucosa which was formerly pale, swollen and boggy was found to be firm, pink and of normal thickness lying snugly against the bone of the underlying turbinate and without ulceration, crusts or atrophic areas. The sense of smell was not impaired.

Of the 900 cases treated follow-up replies were obtained from 568. 87.3 per cent reported benefit varying from a few

months to several years. The average amount of the procaine sodium psylliate mixture used in all cases was 4.36 cc. although in those cases reporting the most benefit the average quantity used was 5.09 cc. per patient.

The author feels that sodium psylliate solution is much to be preferred to topical sclerosing solutions such as silver nitrate and caused less swelling and pain than the similar use of morrhuate solutions.

Fuller[23] reviews a series of 209 asthmatic children attending an allergy clinic over the years 1947 to 1951. He considers that such a clinic reduces the loss of school time and anticipates the secondary effects which influence wage-earning and even length of life.

Sixty of the children had had their tonsils and adenoids removed before being referred to the asthma clinic. A further 47 underwent tonsil and adenoid operations. Forty children had antrum washouts and eight had other intranasal operations. All those children who suffered from rhinitis were given decongestive drops. He does not believe that this treatment in his hands has aroused symptoms of bronchitis.

The standard method of prophylaxis against attacks has been the regular administration of pheno-barbitone, but children who are constantly wheezy receive ¼ or ½ gr. (16 or 32 mg.) of ephedrine regularly with the phenobarbitone.

Phenobarbital in doses of ¼ or ½ gr. (16 or 32 mg.) according to age, once or twice daily, was prescribed for most of the patients and was continued for long periods.

This article was considered by Hamblen-Thomas[24] as valuable and instructive but he was curious to know whether the author thought that the tonsils alone might be the cause of the asthma. In the experience of Hamblen-Thomas the pathological adenoids were the important factor in keeping the nasal and sinus mucous membranes in an unhealthy state, and, by extension, the bronchial mucous membrane as well, causing a varying amount of respiratory obstruction and

chest movement defects. From custom the tonsils in children are commonly combined with the adenoids for criticism and execution, but he believes that for several reasons this should not be so. He does not think that the adenoids or tonsils if pathological) are a causative factor but only a contributory factor. This has been his experience in children with asthma in his practice. He suggests that it is possible that the greater operation of removing the tonsils might act as a trauma initiating asthma in a nervous child.

Loch and Fisher[25] of Baltimore have made a follow-up study of 263 patients who had received nasopharyngeal irradiation not less than five years ago. They found no late detrimental effects. In about two-thirds of the patients examined there was a small amount of lymphoid tissue present in the nasopharynx indicating that the dosage recommended by Dr. Burnham and used for 25 years by Dr. Crowe and his associates, fulfills the requirement that all lymphoid tissue not be destroyed. The Eustachian tubes were not overgrown with lymphoid tissue in any of the patients, which indicates that the radium treatments retarded the growth of adenoid tissue effectively in this location. The late results were very encouraging especially in those cases with mechanical interference of the eustachian tubes.

It had been noted previously that children with hearing difficulties who had been treated by irradiation of the nasopharygeal lymphoid tissue showed a significant reduction in the frequency of common colds. This led observers to try radiation of the nasopharynx, in cases of asthma, with favorable results.

Because of this, Mueller and Flake[26] decided to carry out their own investigation on children with asthma of infectious origin. They used the standard 50 mgm. Monel-metal applicator to each side of the nasopharynx for eight to ten minutes. They gave a series of three applications at one to four weeks apart. Some children had X-ray applications to the area, and these gave exactly the same results as the radium. of the group of 41 children, 27 per cent obtained complete relief for periods from two to four years. Forty-one per cent

were free from asthmatic attacks with upper respiratory infections for 18 months to four years—12 per cent of the patients had only a fair result and 20 per cent were unsatisfactory.

From this study the writers concluded that it seems that irradiation of the nasopharynx in children who have asthma associated with respiratory infections is a valuable therapeutic adjunct.

BACTERIOLOGY.

Hultman[27] presented a paper at the Pediatric section of the Swedish Medical Society in which he discussed a comparison between bacteriological pharyngeal and nasopharyngeal samples. He said that nasopharyngeal samples can be taken with less inconvenience to the patient and the big sources of error in the pharyngeal samples are largely eliminated.

In support of his conclusion he mentioned 119 cases of infection in the air passages from which simultaneous pharyngeal and nasopharyngeal samples had been taken. In 63 per cent, the nasopharyngeal samples gave superior results, while in 14 per cent, the pharyngeal samples proved better. Identical results from both samples were obtained in 23 per cent.

PHYSIOLOGY.

Colson[28] has conducted some interesting studies on sinus drainage. Bernoulli action during the act of nose blowing can be very effective in forcing muco-pus from an involved sinus through the ostium into the nasal cavity. The necessary prerequisites are muco-pus at a sinus opening with residual air in the cavity and a constriction in the nasal airway. With this setup when the patient forcibly blows, sniffs or sneezes the air rushes past the narrow portion creating a lower pressure in that area into which the material is forced by the greater pressure of the residual air in the sinus cavity. He postulates that when the sinus cilia have condensed the mucous at the ostium an air seal is formed which as the

cilia continue to try to force the material through the ostium results in a slight diminution in the air pressure in the sinus. This he suggests may serve as a stimulus for a sneeze or a nose blow.

TONSILS AND ADENOIDS.

Emerson[29] on the basis of anatomical study and experience in 634 cases, believes that hemorrhage occurring after tonsillectomy is not due to the causes commonly given but rather to a hole in a blood vessel and maintains that such hemorrhages can be prevented by proper closure of the wound and well-selected antibiotic therapy. His patients were all ages: 67 were under three years of age, 190 were between four and five years of age.

The anesthesia of choice was given either through a Davis-Crows or McIvor gag with the patient in a modified Rose position. Once the gag is in place the tonsil is grasped with a tenaculum and an incision is made through the mucous membrane at the upper pole on the anterior pillar. This is widened by blunt dissection with scissors until there is room enough for insertion of a pillar retractor at which point the scissors are replaced by a blunt dissector. Suturing is usually but not necessarily begun at the lower pole. The sutures are most easily entered at the point where the posterior pillar meets the floor of the fossa. The needle is then passed under the true floor of the fossa and is brought out as near as possible to the junction of the anterior pillar and fossa. The suture is then tied. If the surgeon prefers, four or five interrupted sutures will usually give a clean even closure with no undue tension on the pillars. He uses plain "o" catgut for suturing. The pillars are not included in the closure.

He makes the following claims:—The post-operative course is shortened because the size of the area left to heal is greatly reduced. The average child's throat heals within five days and most adults can be at work by the end of a week. The so-called late bleeders do not occur, simply because with the fossa closed, the bed of granulations from which these hemorrhages arise does not form; in other words,

the wound heals by primary intention. Post-operative infection has been no problem in this series. Since the spring of 1951 all patients were given 300,000 units of procaine penicillin G on the day of and on the day after the operation as a prophylactic measure.

Wallace and Jones[20] state that although 1500 children are operated upon each week in England for the removal of their tonsils and adenoids they have failed to discover any report of a fatal staphylococcal septicemia following this operation and that, in consequence, such occurrence, particularly when it was carried out under an umbrella of penicillin, is worthy of record.

Their patient, a girl aged 16, was admitted for removal of tonsils and adenoids with enlarged tonsils and adenoids, a septic tooth and slight nasal discharge. Because she had a slight mitral stenosis she was placed on one ml. of "distaquaine penicillin", twice daily, and this was continued for eight days after operation. Convalescence was uneventful until the eighth day when secondary hemorrhage from the adenoid bed occurred. The hemorrhage stopped spontaneously. She was given a further 1 ml. of distaquaine penicillin on the ninth and tenth days after operation and was discharged on the thirteenth day apparently fit and well.

On the fifteenth day she woke up with severe frontal headache and fleeting joint pains which progressively increased. Her family physician gave her daily injections of penicillin on the sixteenth, seventeenth and eighteenth days; but as her condition steadily deteriorated she was re-admitted to hospital on the twentieth day. She was transferred the same day to an infectious disease hospital with a tentative diagnosis of an incompletely treated coccal meningitis. In spite of heavy treatment she died within twenty-four hours of admission.

The autopsy report is given in detail. Sections from abscess areas all showed large numbers of gram positive cocci. No definite primary focus of infection could be identified at the post mortem examination. It appears, however, a reasonable

presumption that the staph. aureus isolated in this case from various sources having the same phage pattern was introduced through the raw surface of the adenoid bed since a secondary hemorrhage which occurred from it on the eighth post-operative day was almost certainly due to infection.

Harkins[31] points out that bleeding is the commonest surgical complication in the field of otolaryngology and that therefore, prompt recognition and control must be mastered by every ear, nose and throat practitioner.

Among other observations he stresses that most post-operative bleeding following tonsillectomy and adenoidectomy occurs during the first 12 hours, and that the patient must be carefully watched during this period, especially for increased swallowing, rise in pulse rate, spitting of bright red blood or restlessness or anxiety. All of these symptoms call for immediate and careful examination of the nose, nasopharynx and oropharynx. One should never walk away satisfied until all possible bleeding areas have been carefully explored and hemorrhage controlled.

He warns against the use of an inhalation anesthetic in a child who has lost enough blood to be bordering on or actually in surgical shock. If an anesthetic becomes necessary, adequate transfusion of whole blood must first be given. If immediate suturing has to be done it should be done without anesthesia or with local infiltration with procaine hydrochloride.

He favors the suture method rather than ligation for bleeders, because he feels a ligature may easily slip off due to the constant moving of the pharyngeal musculature.

For post-operative nasopharyngeal bleeding the post nasal tampon is the only reliable method of control unless, of course, the bleeding point can be seen and sutured.

Oxidized cellulose packs are recommended for nasal hemorrhages and as added protection when a post nasal tampon has not completely controlled nasopharyngeal bleeding. When used in the latter instance both nasal passages must be tightly packed with the material.

When hemorrhage of the nose and throat is not properly controlled by these methods, external carotid ligation must be done above the superior thyroid artery at the level of or slightly above the superior cornu of the thyroid cartilage.

With respect to the prevention of secondary bleeding following removal of tonsils and adenoids, the best results are achieved when acetylsalicylic acid and salicylic acid chewing gum are prohibited. Further prophylaxis is obtained by the use of Vitamin C and Vitamin K combined.

Fox[32] studied 1746 consecutive cases of tonsillectomy in an effort to determine the causes and methods of prevention of post-operative bleeding. Primary bleeding, he feels, may be minimized by careful surgical technique plus thorough preoperative history and laboratory examination where indicated to avoid operating on patients with disorders of blood clotting mechanism. He goes more deeply into the causes and methods of prevention of secondary hemorrhage. In particular the use of aspirin systemically or locally in the form of aspirin gum was studied.

The effect of aspirin on post-operative secondary hemorrhage is likely due to an adverse local effect on the coagulum covering the wounds and is not in many cases due to a general depression of the pro-thrombin level, first because the usual dosage is too small and second because in this series the simultaneous administration of Vitamin K did not effect a decrease in the incidence of secondary hemorrhage. The most significant thing was that the elimination of aspirin locally caused the incidence of secondary bleeding to be reduced from 9.9 to 1.3 per cent, and the routine use of long acting procaine penicillin resulted in a further decrease to 0.95 per cent.

Penn[33] in a series of 37 children and eight adult tonsillectomy patients injected the anterior and posterior pillars with efocaine at the conclusion of the operation. This is a long acting local anesthetic which works on the following principle: the solution injected is at critical saturation limits and when diluted by even minimal quantities of aqueous fluid

such as extracellular fluid or serum complete crystallization of the anesthetic agent occurs which creates an anesthetic depot which is released gradually. The agent is completely absorbed and histopathologically there is no foreign body reaction, no neurodegeneration and no evidence of inflammatory reaction. The solution appears to be innocuous to the tissues. Clinically the results were dramatic. A high degree of local and referred pain control was achieved for approximately five-six days after which time some of the patients experienced a return of local soreness. There were no untoward reactions, no delay in healing and no post-operative hemorrhages observed; moreover the local anesthetic effect does not appear to interfere with swallowing.

The series was admittedly small, but the results make this method worthy of wider application.

Davidson et al[34] report on the use of efocaine following tonsillectomy on eight children and nineteen adults. The drug was used on only one tonsil fossa and the patients were unaware of the experiment. 1.5 c.c. of the solution was injected submucosally along the anterior and posterior pillars of one side only.

The results were in the eight children who had their tonsillectomies under general anesthetic and then had the efocaine injected:

Two reported no pain on either side

Three complained of equal pain on both sides of the throat

One stated the injected side felt better

Two thought the pain on the injected side was worse

The results with the 19 adults who had their tonsils removed under local anesthesia before the efocaine was injected:

Four patients said the injected side felt better

Five complained of equal pain both sides of the throat

Ten felt that the injected side hurt worse than the opposite side.

From these observations the authors felt that efocaine is of questionable value in reducing pain following tonsillectomy.

Moulden[25] considers that foreign bodies embedded in the tonsil are sufficiently rare to warrant recording. He had seen a 16 year old girl who was referred because of the presence of something hard in the tonsil. This had caused no discomfort, but the patient had noticed something unusual about the right tonsil when she was looking at her throat in the mirror. A greyish mass was seen at the site of the opening of the crypta magna of the right tonsil. This was hard and brittle to the touch. The mass was removed and found to be a rough concretion about ⅜ by ½ by ⅜ in. (1 x 1.3 x 1 cm.) in which was embedded a primary incisor tooth. Neither the patient nor her mother could remember any incident in which a primary tooth could have been lost.

Guggenheim[26] in an important paper stresses that adenoidectomy is still the most unsatisfactory procedure that the otolaryngologist is called upon to perform. The majority still attempt removal without the aid of sight by use of the La Force adenotome. Any remnants are supposed to be detected by the gloved finger and are then attacked by friction with the gauze-covered finger or the curette. Both these methods are unsatisfactory.

He feels that the Love retractor is by far the best method for direct visualization of the nasopharynx. He advocates its use for diagnosis and states that its use in children is more satisfactory to the examiner and less alarming for the young patient than the use of the nasopharyngoscope. Experience in this procedure in the unanesthetized child can be gained by practice on the anesthetized patient. The retractor must be used gently and there should be no bleeding.

The paper is mainly concerned with the use of the Andy Love retractor for the meticulous removal of adenoids under direct vision either by sharp dissection or with punch forceps. The main adenoid mass is first removed by LaForce Adenotomes using first the largest possible adenotome and then under direct vision the smallest possible La Force adenotome.

The nasopharynx is again examined using the Love retractor and brilliant illumination on the operator's head and remaining adenoid tissue removed as cleanly as possible by sharp dissection or punch forceps. Special attention is directed to the lateral curtains of adenoid tissue along each nasopharyngeal wall which can be easily observed to fall over the eustachian tubal orifices with resulting obstruction. These curtains are especially important in cases of hearing difficulties or of otitis. In hearing cases he further advises gentle dilation of the Eustachian tube with the Gyergyai olives.

With regard to radiation therapy he prefers X-ray treatments by a competent radiologist rather than by the nasopharyngeal applicator.

COMMENT.

This is an excellent paper and while we do not agree with all his statements we recommend that this report be read in its entirety by all practitioners of otolaryngology.

Wilson[37] reports findings two oatseeds in adenoids in a boy aged seven. After removal of the tonsils, palpation of the nasopharynx with the forefinger revealed a large pad of adenoids and a central sweep was made with a Popper's type guarded adenoid curette. After withdrawing the curette and before it was emptied, it was noted that two long whiskery projections were issuing from the adenoid mass. These proved to be the ends of two oatseeds which were embedded in the central fold of the lymphoid tissue. From the history it is probable that the oatseeds had been in the nose or adenoids for three months. A photograph of the specimen accompanies the article.

POLIOMYELITIS AND TONSILLECTOMY.

Top[38] states that poliomyelitis is a highly infectious disease, and most persons have had it in a subclincal form by the time they become adults. Recognizable or paralytic cases are relatively few, and the ratio of subclinical to clinical infections is estimated at upwards of 100 to 1. Little that we know concerning the disease affords a satisfactory answer to this phenomenon.

He presents a study of 1947 patients who had had poliomyelitis during the 1940-1949 decade at the Herman Kiefer Hospital, Detroit. The results are presented in eight tables. He considers the present statement to be one contribution to the body of information concerning the problem of the relationship of poliomyelitis to tonsillectomy; all the evidence is not yet established for adequate consideration of the implications to the present moment; the findings are in keeping with and supplement those of Aycock who made a nearly similar study in 1939.

In the present group 1011 patients gave a history of and on examination showed evidence of removal of tonsils. The proportion having undergone tonsillectomy was 51.9 per cent. High percentages of patients who had had tonsillectomy had had the bulbar and spino-bulbar types of poliomyelitis. The rates for these types were 85.1 per cent and 68.7 per cent respectively, as compared to 45.6 per cent for the non-paralytic and 43.1 per cent for the spinal type. The fatality rate of 93.5 per cent for the bulbar type when tonsils had been removed is still more striking and is in marked contrast to that for the spino-bulbar type (56.9 per cent). The time elapsed between tonsillectomy and an attack of poliomyelitis was studied, and the results were expressed by graded intervals. The proportion of patients with a history of tonsillectomy within one month of an attack was only 3.1 per cent and for the period under one year 8.3 per cent.

The explanation as to why removal of tonsils should produce more frequent higher center paralysis at an interval of a month or less of the operation is not difficult to understand in view of the pathogenesis of the disease and experimental work. It is more difficult to find a reason for cases occurring at later intervals during the first year and for any time thereafter in life. The value of tonsils to mankind has been a source of controversy for many years, although the multiple areas of lymphoid tissue that make up Waldeyer's ring and of which the tonsils are a part are considered to have some function relating to local immunity. It is possible

that the removal of tonsils affects the portal of entry in some way or that their absence interferes with normal physiological mechanisms or the local immunity status of the mouth and posterior pharynx. Frankly, at this time, the significance of differences noted among persons with tonsils present or absent and the occurrence of poliomyelitis cannot be adequately explained for interval periods beyond one month.

These data are challenging in their implications and call for sober judgment with regard to the desirability of tonsil removal except for excellent clinical indications. The nonremoval of tonsils may be as hazardous to a person or much more so than their removal, for the chance of contracting poliomyelitis in a clinically recognizable form is not great; yet the data presented are strongly suggestive of a greater chance of contracting a severe form or of a fatal termination, if tonsils have been removed at some time prior to an attack of poliomyelitis.

Wilson[39] presents a short essay on the relationship of tonsillectomy to incidence of poliomyelitis that is so admirably expressed that it is impossible to condense it adequately. The entire original article should be read.

The question of the relationship of tonsillectomy to poliomyelitis has become more than a scientific one of virology or epidemiology and now involves problems dealing with the philosophy of medical practice. The problems which have arisen for both pediatricians and otolaryngologists resolve themselves into a matter of weighing one estimated risk against another. He states that, as he is neither a virologist nor an epidemiologist, but only a clinician, he has to make decisions on inadequate data, weighing one risk, partially known, against another risk, evaluated as best he can. In making any clinical decision, such as the proper time to do a tonsillectomy or to carry out an immunization procedure, such weighing and balancing must be made; but he believes that there should never be any question of weighing an identifiable risk to a patient against the convenience of a physician.

Repeatedly, and by several workers, a bulbar type of poliomyelitis has been produced in monkeys after tonsillectomy, usually most successfully when the operation is carried out immediately subsequent to the swabbing of the tonsillar area with virus. It can, therefore, be said positively that there is ample theoretical ground for understanding how a tonsillectomy can lead to a consequent attack of poliomyelitis if the operation is carried out at the time when the virus is in the throat. It has also been established, using monkeys as experimental animals, that a polio virus placed in contact with the proximal end of freshly severed nerve trunks will invade the central nervous system by way of the axones of those nerves and set up first a localized and then a generalized reaction leading to typical disease, clinically and pathologically.

He does not review the many investigations and publications relating to the incidence of poliomyelitis in relation to tonsillectomy as gathered from epidemiological studies; but he mentions the various types of these and composes two tables to show quite diplomatically how some of the data presented support a conclusion the exact opposite of one that was deduced. The conclusion had been that no relationship had been found between tonsillectomy and poliomyelitis: the analysis he presents shows evidence of almost twice the incidence of poliomyelitis in those who have had tonsillectomy within two months before the disease as in patients who have not had tonsillectomy.

He personally believes that there is a very important causal relationship between tonsillectomy and bulbar poliomyelitis and that a tonsillectomy in certain circumstances may greatly increase the risk of a fatal disease; but he suggests that the assumption be made that the matter is still in question, that there is still doubt of it, and that all conflicting data are equally respectable. Since there is every theoretical reason to believe such a relationship might occur, and since an unsettled question implies a risk, as a clinician one must assume that an actual risk, even though small, is involved in doing a tonsillectomy in the poliomyelitis season. As a

clinician he does not feel that it is necessary to wait for evidence of such increased risk to be expressed in dependable quantitative terms before he takes some action. He can only ask what is the risk of postponing the tonsillectomy and then try to weigh the one risk against the other.

The British Medical Journal[10] states there are certainly reasons for believing that tonsillectomy may precipitate or aggravate an attack of poliomyelitis. The effect of old or recent tonsillectomy on the total incidence of poliomyelitis has been a matter of debate and contradictory conclusions have been drawn. It reviews three American contributions to the knowledge of these problems.

An analysis by A. H. Miller of cases of poliomyelitis in Los Angeles City and Los Angeles County, showed that the incidence of poliomyelitis did not differ significantly between persons who had had tonsillectomy and those who had not. The prognosis appeared to be poor when a patient had tonsillectomy less than a month before developing poliomyelitis. The percentage of patients who had a recent tonsillectomy and developed bulbar type of poliomyelitis varied from 28.5 to 75 during 1949 to 1951 compared with 15 to 18.5 for all patients. The total number of patients with recent tonsillectomies was was only 20 so that undue emphasis cannot be placed on this finding.

The second study was of the records of 1947 poliomyelitis patients admitted to the Herman Kiefer Hospital during 1940-49. Of the patients who had had tonsillectomies within a month of developing poliomyelitis, 57 per cent contracted the bulbar and spino bulbar type, compared with 33.5 per cent for all patients with tonsillectomy. Unfortunately, the proportion of tonsillectomized children in the general population was not known, so that the effects of tonsillectomy on the level of the general incidence of poliomyelitis is speculative.

The third study was by J. L. Wilson who quoted the findings of other workers. In an inquiry into the epidemic in Utah in 1943 the incidence of poliomyelitis is given as 2½

times as great among tonsillectomized children as in the general child population and the incidence of bulbar cases as 16 times as great.

From the data in the first two studies it appears that the incidence of poliomyelitis is approximately the same in children who have and have not had tonsillectomy. If the operation was carried out less than one month before the attack of poliomyelitis then the chance that the patient develops the bulbar types and of being more critically ill is increased. The number of patients who had tonsillectomy in the month preceding the attack of poliomyelitis was small and did not affect to any extent the overall incidence of poliomyelitis in the Los Angeles data.

MOUTH AND THROAT INFECTION.

Acute Rheumatic Fever, states the Lancet in a leading article[41] is a complication of a group—A B—hemolytic streptococcal infection of the throat of a susceptible person. This is a proposition which is now well established, and two corollaries seem equally sound—namely, that infection by no other organism gives rise to acute rheumatic fever, and that all persons with acute rheumatic fever have had antecedent streptococcal throat infections. Medical science has a way of finding exceptions to such dogmatic statements, but the general truth of these is widely accepted. It follows that if one can prevent streptococcal throat infections, one can prevent rheumatic fever, and this too has been abundantly confirmed. What we do not know is why, of 100 patients with apparently identical infections of this type, 98 recover completely and two get rheumatic fever.

Attempts at preventing rheumatic complications by avoiding or preventing the initiating streptococcal infection have met with striking success. In the past it has been supposed that removal of the tonsils would decrease the incidence of rheumatic fever, but this is not borne out by experience. The recent war, by ensuring that young men were herded together in barracks, camps, and ships, afforded many opportunities for the epidemic spread of streptococcal infections,

which left rheumatism in their wake. Sulphonamides in small doses were used to prevent this spread of infection, and the incidence of both streptococcal infection and rheumatic fever was reduced. Once a throat infection is established, however, sulphonamide treatment is of no use in preventing rheumatism; and, while it has proved safe enough to use sulphonamide to protect a particular person from infection at home or in hospital, long continued use of this agent in the mass prophylaxis of all members of a closed community has so altered the bacterial environment that, when sulphonamide-resistant strains of group—A B—hemolytic streptococci emerged, their pathogenicity and spread was actually enhanced —a counter-attack by the organism only controllable because penicillin was now in reserve.

Much of the early work with sulphonamides was repeated with penicillin when this antibiotic grew plentiful. It became apparent not only that penicillin was equally effective in preventing streptococcal infection but also that early vigorous treatment of exudative tonsillitis could abort these infections quickly enough to reduce the likelihood of subsequent rheumatism. Penicillin treatment should be early. The case of sore throat caused by the group-A B-hemolytic streptococcus is usually characteristic enough to make bacteriological confirmation unnecessary before starting treatment. Typically there is a relatively rapid onset with soreness in the throat on swallowing, painful and swollen cervical lymph nodes, malaise and fever. Young patients often vomit during this period. There is general swelling of the lymphoid tissues of the pharynx and bright-red inflammation of the faucial mucosa. All observers agree that most of the more severe sore throats are caused by this group of streptococci, and it, therefore, seems reasonable policy to treat all moderate or severe sore throats with penicillin by intramuscular injection.

Children recovering from rheumatic fever should be given chemoprophylaxis with either sulphonamide or penicillin for at least two years and some would say even longer. The practical implications of such a general policy are discussed. Over against the difficulties and expenses of such a policy

must be set the fact that rheumatic fever and its sequelae are among the major causes of loss of years of life and of capacity to do productive work—a cost to the country which must, by comparison, be enormous.

Stewart and Hewitt[12] comment on a statement in the above article which is in conflict with the findings of a recent enquiry under the auspices of the Rheumatic Fever Committee of the Royal College of Physicians.

A group of 31 rheumatic children, for whom a history of tonsillitis had been recorded before the onset of their rheumatism, was compared with a control group of 70 children, who had also suffered from tonsillitis but had not subsequently developed rheumatism. It was found that 36 (51 per cent) of the control group, but only six (19 per cent) of the rheumatic group, had undergone tonsillectomy. This difference was far too great to be attributed to chance and implied that the liability to rheumatic fever of children with tonsillitis may be reduced by about two-thirds when the tonsils are removed (i.e., 42 per cent of the unoperated but only 14 per cent of the operated cases of tonsillitis belonged to the rheumatic group of children. They were not, however, able with the records at their disposal to exclude the possibility that there might have been some cases in which rheumatic fever intervened between a decision to perform tonsillectomy and a suitable occasion for operating. If this were the case the advantage of tonsillectomy would have been overestimated to some extent.

The Medical Research Council Report of 1927, which was cited, does not contain any direct evidence on the value of tonsillectomy; it records 60 cases in which tonsillectomy had failed to prevent rheumatic fever but makes no comparison between operated and unoperated cases. The authors of the report concluded that "complete removal of the tonsils does not appear to afford absolute protection from attack by rheumatism" but this conclusion is compatible with the view that tonsillectomy is an effective means of reducing the incidence of rheumatic fever after tonsillitis.

Layton[43] wrote that he was worried, after the appearance of the above letter by Stewart and Hewitt, lest the demon pantonsillectomy should again raise its head. He states that he gave almost daily thought for nearly forty years to the reasons for refraining from tonsillectomy.

He tells the story of a physician-in-charge, who thought it would be well for the whole population to be tonsillectomized by the age of one; in that way only could acute rheumatism be stamped out, and this disease was the foremost problem in national health. He believes it is of importance to know into whose hands the patient has got before the operation was done. Was it the rheumatico-pantonsillectomist or just the enthusiast for the focus-of-sepsis hypothesis? Was it at a station in which the majority or nearly 50 per cent were set aside for operation or in a clinic in which every aspect of the child's health was carefully inquired into, and a minimum of at least a quarter of an hour was given to the patient before the patient was advised to decide that the operation should be done. The value that can be attached to any statistics very largely depends upon which of these sources they came from.

He concludes that it would be a pity if a letter from a scientific institute which carries with the profession and with parents so much more weight than the experience of clinicians, should result in this operation-rate starting to climb again; especially now that it seems that acute rheumatism may be stamped out without operation.

Curnow[44] considers that the letter of Stewart and Hewitt reveals a torturous method of reasoning. The value of tonsillectomy in preventing acute rheumatism is assessed on a tiny number (70) of children who had suffered from tonsillitis but had not developed rheumatism and a minute number (31) of rheumatic children who have previously suffered from tonsillitis. He believes that the only sound way to assess the value of tonsillectomy in preventing rheumatic fever is to follow up the history of a few thousand children who have had their tonsils removed for tonsillitis and a few thousand children who have not had their tonsils removed in

spite of tonsillitis and to find out what proportion of the two groups subsequently developed rheumatic fever. This was done over 20 years ago by Kaiser.

Earnshaw[45] with reference to the letter from Stewart and Hewitt, states, that there is an important point not generally taken into consideration when statistics are studied.

He was at one time an onlooker at an investigation into the incidence of upper respiratory tract infections in (*a*) children who had had the tonsils and adenoids removed and (*b*) those who had not. The investigator's method was to ask each child: "Have you had your tonsils and adenoids removed?" No examination was made. Of twelve of the children who had answered "Yes" and whom I was able to examine later, all had tonsillar tissue in the fauces—in two or three it was almost impossible to detect that tonsillectomy had even been performed, etc. These children, however, were rated as having had the tonsils and adenoids removed.

He suggests, therefore, that when tonsillectomized and other children are to be compared for any purpose, those who are found still to have tonsillar tissue in the fauces or nasopharynx should not be included in the investigation as having had the tonsils and adenoids removed. Obviously the children should be examined by an experienced person.

Cancrum Oris in children in temperate countries is usually a complication of rubeola, typhoid, typhus, etc. This is not so in the tropics, according to D. B. Jelliffe[46] who reports on cases from Western Nigeria. The children he studied all showed evidence of severe malnutrition for a prolonged period. The diets were greatly lacking in protein and Vitamin B, since the main diet consisted almost entirely of carbohydrates and water.

In the cases investigated, 75 per cent showed Vincent's organisms. It is felt that the child develops a Vincent's gingivitis, and because of the malnutrition the infection spreads along the roots of the teeth to involve the underlying mandible, with subsequent bone necrosis. In the more severe cases it spreads from here to the adjacent soft tissues by

direct contact. Gangrene of the inner surface of the cheek results with wide destruction of tissue. The treatment was penicillin and a high protein diet. Penicillin 150,000 units once daily was administered until all necrotic material had sloughed to leave a clean surrounding area. In some cases, this took two months, but the immediate effect on the child's general condition was dramatic. A remarkable degree of natural healing took place, but in some cases an opening persisted in the cheek which allowed the escape of saliva and food particles. A pad was worn over this area as it was impossible to carry out plastic surgery in Western Nigeria.

FRACTURES.

Fomon[47] et al have written a very comprehensive paper on the management of recent nasal fractures. They point out that very minor inaccuracies in reduction may cause serious impairment of function and conspicuous derformities.

The practice of blind realignment of fragments lacks the assurance of precise reduction and they feel that most if not all nasal fractures should be treated by open reduction by rhinoplastic technique. So far they have not used these methods on children because of reluctance to put the child through the hazards of prolonged anesthesia and the fact that most rhinoplastic instruments are too large. They do, however, plan to equip themselves with instruments particularly designed for children. When enough experience is obtained they promise to publish the findings.

This is a paper that deals extensively with the treatment of a wide variety of injuries to the supporting structures of the nose and is well worth reading in full.

The main premise of the report is that open reduction of all nasal fractures is preferable providing the operator has had an adequate training in rhinoplasty. Open reduction is time consuming and requires special instruments but precise alignment is assured and post-operative deformity and impairment of function are considerably reduced.

SURGERY.

Whelan[48] warns us to be on guard against too much conservatism in the treatment of nasal and paranasal conditions. He urges that one should remember that there still exists a number of cases which require surgery which must not be too long delayed or overlooked. In particular the inclination to be conservative by intranasal surgery must not stand in the way of more extensive extranasal measures if the patient's life is in danger.

Hitschler[49] in a paper on cardiac arrest points out that every surgeon should be familiar with cardiac massage and resuscitation. Many lives can be saved by this process, and the lay public is fast becoming educated and physicians are being sued for not performing this procedure.

The incidence of cardiac arrest is uncertain. In a 700 bed hospital there may be five cardiac arrests yearly (Beck).

There are many possible causes. Anoxemia stands out preeminently. Vagal stimulation may be responsible and otolaryngologists are, therefore, particularly vulnerable to this misfortune. Too light anesthesia and anoxemia both predispose the patient to vagal irritation. The use of atropine or scopolamine is strongly recommended for blocking effect on the sinoauricular pacemaker. Toxins or poisons may cause respiratory or cardiac failure and if there is an idiosyncrasy to a drug a fatality may result even when the drug is given in small dosage.

Resuscitative measures must be commenced as soon as there is no pulse or blood pressure. There is no time to listen with a stethoscope or attempt such measure as dilating the rectal sphincter or injecting the heart with epinephrine. Sterilization of the hands is an unnecessary delay. Oxygen supply to the brain must be restored in three-five minutes or irreversible changes result.

The best approach is by a long incision from the sternum along the fourth interspace all the way down to the bed or operating table (one foot long in adults). A cartilage is

clipped at the sternum, the ribs separated and the operator's hand inserted to begin massage. At this point the circulation is started and the immediate emergency is over. If natural rhythm is not soon restored injection of epinephrine and/or one per cent procaine are necessary according to whether or not fibrillation is present. A defibrillating machine should be available in the hospital.

While these surgical methods are being instituted the anesthetist inserts an endotracheal tube and commences artificial respiration by the bag on the anesthetic machine or by mouth insufflation if necessary.

After normal rhythm has been established bleeders are tied and the chest is closed. Post-operatively the patient must be under constant surveillance and appropriate measures taken. Coma lasting over 12 hours indicates a poor prognosis.

Prompt diagnosis, courageous decision and intervention based on a rehearsed plan of action can prevent fatalities which at the moment seem inevitable.

The Journal of the American Medical Association[50] answers as follows to the question of what should be done for the nose of a nine-year-old boy which is 95 per cent blocked by a smooth deflection of the nasal septum and irritated by a low grade chronic infection of the antrum:

"The presence of a pronounced deflection of the nasal septum in a nine-year-old child does not necessarily constitute an indication for immediate correction. The problem should not be thought of in terms of correcting an anatomic deformity nor should the age of the patient be a deciding factor. Unless the deflected septum is accompanied by troublesome nasosinal and systemic symptoms, surgical intervention should not be considered until a regimen of conservative medical thereapy has been found ineffective. Even moderate improvement should encourage the continuation of such a program. Submucuous resection of the septum should, however, be considered in the event of disturbed respiration, inadequate paranasal sinus ventilation and drainage, and, in the case of this child, the persistence of the chronic maxillary

sinus infection, despite adequate medical attention over a period of months. Frature of the septum toward the midline is inadvisable."

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GEORGIA SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY.

The Georgia Society of Ophthalmology and Otolaryngology will hold its Spring meeting March 5th and 6th, 1954, at the General Oglethorpe Hotel, Savannah, Georgia. The speakers will be Dr. Paul Chandler, Boston; Dr. A. B. Reese, New York; Dr. Henry P. Wagener, Rochester; Dr. L. R. Boies, Minneapolis; Dr. Francis LeJeune, New Orleans, and Dr. J. H. Maxwell, Ann Arbor.

MANAGEMENT OF CONGENITAL EAR CANAL ATRESIA.*†

HOWARD P. HOUSE, M. D.,
Los Angeles, Calif.

HISTORICAL REVIEW.

The surgical correction of congenital ear canal atresia, or aplasia as Kinney[1] suggests, is not new. Kesselbach,[2] in 1883, described such a case which he operated but failed to obtain a satisfactory result. Dean and Gittens[3] reported the first successfully operated case in 1917, in which a satisfactory hearing result was obtained. Their description of a movable incus which was not removed at the time of surgery is most interesting. Beck and Adler[4] discussed the psychological aspects of this deformity. Frazer,[5] Richards[6] and Altman[7] thoroughly describe the embryological development. Hume and Owens[8] stated unilateral cases should be operated upon for psychological reasons, as well as for any hearing improvement which might result. Benton Colver[9] reported in detail his findings in a bilateral case in which a satisfactory hearing improvement was obtained. Colby Hall[10] in 1934 stated that only patients with bilateral involvement should be considered for surgery.

In 1943 Cohen and Fox[11] likewise concluded that surgical intervention should be reserved for bilateral cases. Ombredanne[12] in 1947 described two cases of unilateral atresia in children which he successfully fenestrated and obtained a practical hearing level. He placed a Thiersch graft over the fenestra. George Pattee[13] in 1947 reported a series of five bilateral cases, four of which obtained an improvement in hearing. Pattee stated that the deformed and fixed incus and

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†From the Department of Otolaryngology, University of Southern California School of Medicine.

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malleus, by their continuity with the stapes, resulted in fixation of the oval window footplate. By eliminating this continuity through removal of the deformed incus and malleus, the stapes then became mobile and resulted in a satisfactory hearing improvement as long as this motility was maintained. He subsequently reported in another discussion of this subject an additional three cases which had been operated upon, but only one of which had maintained a satisfactory improvement in hearing. In 1949 Vogel[14] reported a patient upon whom he performed a modified radical mastoidectomy using the postauricular approach. He removed the incus but left the deformed malleus in place. A fenestration was performed and covered with a Thiersch graft. Marked improvement in hearing occurred, but stenosis of the canal developed as the wound healed.

Rosenberger[15] reported a successful unilateral case which was operated upon because of acute mastoiditis. He stated fenestration might be advisable in these cases if the hearing does not reach the practical level following the preliminary operation. This same opinion was expressed by Altman and Holmes.[16]

In 1949, Siirala[17] of Finland described a patient operated upon in 1948, in whom the stapes was found to be fixed and upon whom a fenestration was performed which resulted in a satisfactory hearing improvement. DeGraaf Woodman[18] reported a case in 1950 in which he carried out a two-stage procedure. The first operation created a new external ear canal and freed the stapes by removing the fixed incus and malleus. He placed a split skin graft over the completed radical mastoid cavity, including the stapes, and some improvement in hearing was obtained. Since the improvement did not reach the practical level, a fenestration was later performed which resulted in additional improvement to the practical level. Woodman also called attention to the necessity of using an acrylic mold in the ear canal postoperatively until healing is complete in order to prevent secondary stenosis from developing.

EMBRYOLOGY.

A brief review of the embryology of the ear is necessary to understand the problems encountered in congenital atresia. Kinney suggested the name of "aplasia" instead of "atresia," as the latter denotes subsequent closure of something that was already open, whereas "aplasia" denotes something that should have developed and failed to do so. By definition, however, "atresia" may be used in either sense.

The auditory apparatus is formed in three successive stages: first, the inner ear, then the middle ear, and finally the external ear. This development is such that malformation of one stage does not necessarily mean malformation of another stage; therefore, congenital deformities of the auditory apparatus may be single or in combination. Most frequently, malformations of the external and middle ear are encountered in combination with a normal inner ear structure. It is interesting to note that this deformity occurs more frequently in males than in females.

Perhaps the most concise and clear description of the embryology involved in these cases was presented by Holmes in a discussion of Woodman's article on this subject, as follows:

1. The external auditory meatus and auricle develop from the first branchial groove. Failure to develop gives rise to the deformed auricle and absence of the auditory canal.

2. The malleus and incus are differentiated from the first branchial arch, or Meckel's cartilage, and failure to differentiate results in the fused ossicles.

3. Because the stapes is derived from the second arch, or Reichert's cartilage, and is, therefore, independent of the other ossicles, it is usually found to be normal.

4. The drum membrane is formed by a thinning out of the mesenchymal tissue in the region where the external meatus abuts on the wall of the tympanic cavity. There being no canal, bone is found overlying the entire middle ear and the drum membrane, of necessity, is absent.

5. The inner ear develops from the auditory placode on the lateral surface of the hind brain. This ectodermal plate invaginates to form the auditory pit and vesicle. This vesicle gradually separates from the surface epithelium to form the otosis which differentiates into the epithelium and membranous portion of the inner ear, whereas the bony portion is derived from the surrounding mesenchyme. The development of the stapes is in close proximity to the development of the inner ear because of its direct connection at the footplate; whereas the development of the incus and malleus is closely associated with the middle and external ear. Fortunately, therefore, a normal stapes and inner ear are most often associated in cases in which a deformed malleus and incus are encountered.

Holmes stated that the facial nerve may take a course from the geniculate ganglion between the horizontal canal and the stapes and pass in a circle anteriorly following the location expected of the annulus tympanicus. It then makes its exit from the bone apparently in the glenoid fossa and is often smaller than normal.

Kinney,[19] Woodman,[20] and Boyd,[21] stated instances in which they encountered a malpositioned facial nerve in operating upon these cases. In one, the nerve passed perpendicularly up to the dura instead of its usual bend under the horizontal canal. In the other two cases, the nerve was observed to be superior to the deformed pinna and was uncovered on the initial incision.

Pneumatization of the mastoid varies from none to complete. Fortunately, pneumatization is present in the majority of cases.

GENERAL MANAGEMENT.

Cases of congenital atresia with associated microtia of the pinna are noted immediately after birth, and attention is invariably focused on the deformity with little thought of the hearing problem involved. If the case is unilateral in character, the seriousness of the hearing aspect is greatly diminished and the deformity may well be the primary interest. In bilateral cases, however, the opposite viewpoint must take

precedence. If the infant has an atresia of both ear canals without microtia of the pinna, the problem resolves into one of hearing consideration only.

It is my opinion that unilateral cases should not be operated upon for hearing restoration unless the individual involved so dictates. This cannot be determined until adulthood and, therefore, this discussion will deal only with cases of bilateral atresia or aplasia.

The parents of the child should be made aware immediately of the overall problem involved. The attending pediatrician and plastic surgeon must be educated to the importance of the hearing problem. Until the indications for surgical intervention can be established, every effort should be made to develop "sound awareness" as the baby develops. The parents are instructed to speak loudly to the infant and between ten and fifteen months of age, general amplification may be instituted at short intervals each day. This may be done either by a table aid and head set, or by increasing the volume of the radio or television. These procedures gradually result in sound awareness and speech development.

Roentgenograms should be made at twelve to fifteen months and again just prior to surgery. If the mastoid is found to be well pneumatized, it is probable that a middle ear and ossicles exist, and the prognosis through surgical intervention is enhanced. If the films reveal marked sclerosis, it is less likely that a middle ear and ossicles exist and, therefore, the prognosis is not so favorable.

A technique has been evolved by Dr. Gilbert Roy Owen[22] for determining the presence of a middle ear and ossicles in these sclerotic cases. This technique has been most beneficial as an aid in selecting sclerotic cases for surgery, and I now hesitate to advise surgery in such instances unless a middle ear and ossicles are visible by the Owen technique.

Doctor Owen kindly consented to give a brief description of his method for publication as follows:

"1. In the roentgen consideration of the atresic ear, we know that the presence of normal ossicles is most improbable. At best, the vulnerable

incus and malleus will be deformed in some degree and may exist in forms so primitive as to be practically unrecognizable. It is granted, we assume, that the recognition of ossicular tissue by the X-ray connotes some sort of space to house it, and if such be true, that it should be surgically possible to find at least the stapedial footplate. Should we find definite X-ray evidence of ossicular tissue on one side only, in a bilateral atresia—even though evidence of cochlear functions seems to be equal—it might decide which side would yield the better surgical result.

"2. X-ray technique—If the tympanic membrane is represented by an osseous plate, the visualization of ossicular tissue is not possible in the Law, Schuller, Mayer or Owen projection. Should the area of the atresic canal be blocked by fibrous tissue, in part or *in toto*, the presence of ossicular tissue may be faintly indicated by these same projections; however, by the use of the Stenvers projection, if an ossicular head or heads —though deformed—exist, they may be projected into the shadow of the vestibule and in rare instances, into the upper area of the tympanic cavity, directly under the shadow of the horizontal canal. Given craniums ranging from brachycephalic to dolychocephalic, with the various intervening mutations—plus the combined tangential 45° dorsoventral rotation and a 12° caudocephalad projection of the conventional Stenvers—it is often necessary to take several films before reporting the absence or presence of ossicular tissue. This is accomplished by 3° tilts of the cephalocaudad or caudocephalad projections and various combinations thereof."

Gilbert R. Owen, M. D.
June 18, 1952.

SELECTION OF CASES FOR SURGERY.

The determination of good cochlear nerve function is the most important single factor in selecting patients for surgery. The older the child the greater the accuracy with which this can be determined. The psychological aspect, as well as the speech problem, however, increases in direct proportion to the child's age. In my experience, three to four years of age is the ideal age for surgical intervention. If microtia exists and plastic repair is contemplated, the younger age should be selected so as to allow ample time for the plastic surgery to be completed before the child enters school. Correction of the atresia should always precede the plastic reconstruction because restoration of hearing function and speech development is paramount and creation of a new canal through a plastic area might result in infection and loss of the newly created auricle.

The cochlear nerve reserve of a child three to four years of age can be tested with reasonable accuracy. His responses to airborne sounds, as well as his vocabulary as developed

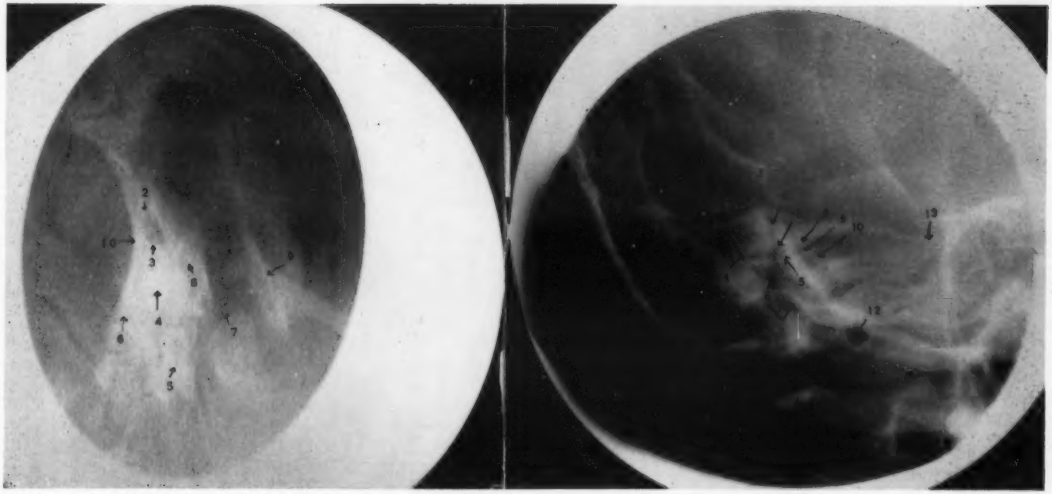


Fig. 1A. Fig. 1.

STENVERS PROJECTION.

Fig. 1. (Anastacio R.) 1. Eminentia arcuata. 2. Vertical canal. 3. Vestibule. 4. Horizontal canal. 5. Head of an ossicle. 6. Tympanic cavity, containing ossicular tissue. 7. Head of the ramus. 8. Roof of the internal auditory canal. 9. Foramen of the VIIth nerve. 10. Cochlea. 11. Area of the mastoidal antrum. 12. Vertebral artery foramen. 13. Tip of the mastoid.

MAYER PROJECTION.

Fig. 1A. (Anastacio R.) 1. The atresic auricle. 2. Infantile antrum. 3. Eminentia arcuata. 4. Mastoid tip. 5 Internal carotoid artery. 6. Internal auditory canal. 7. Head of the ramus. 8. Area of the external auditory canal (absent). 9. Root of the zygoma. 10. Lateral sinus.

by previous amplification means, establishes the degree of inner ear function. In these cases, the average loss by air conduction is a flat 50 to 60 db., with a normal bone conduction curve.

TECHNIQUE OF SURGERY.

After suitability has been established, the technique to be used must be determined. In my opinion, the operation for correction of congenital ear canal atresia is the most difficult surgical procedure we perform on the temporal bone due to the anatomical variations encountered. The bibliography of this subject is very complete regarding surgical technique and should be reviewed by anyone contemplating this surgery.

Pattee described in detail the use of endaural techniques in congenital atresia. One of his most valuable contributions was his statement that in order to avoid scar tissue from enveloping the stapes, the opening into the middle ear should be made only large enough to remove the deformed incus and malleus. This small opening makes it less likely that the graft over the stapes region will contract and interfere with its mobility. He advocates a Thiersch graft and feels that the mucous membrane lining of the middle ear covers the under surface of this graft. Holmes stated that care should be exercised to avoid disturbing the mucous membrane about the middle ear region of the stapes to prevent subsequent partial fixation due to scar tissue.

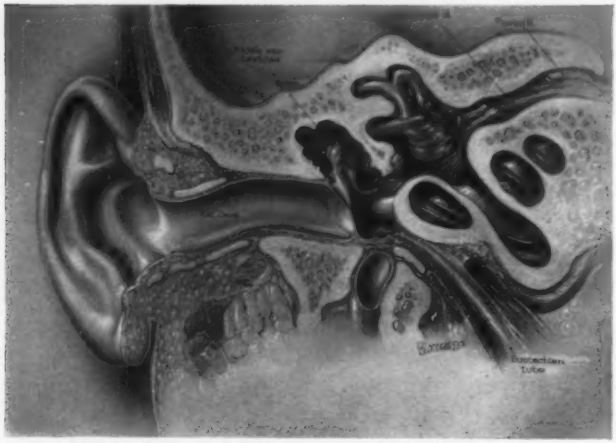
I should like to stress some points which have proved beneficial in my experience:

1. For cosmetic reasons, the incision should be placed anterior to the deformed auricle if microtia exists.

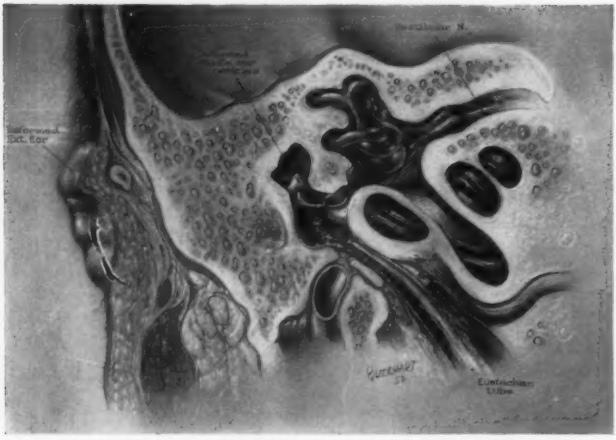
2. A single incision should be used in order to preserve a maximum of epithelium for lining the newly created canal.

3. Because of a possibly misplaced facial nerve, care must be taken during the incision and little undermining of the skin edges should be attempted.

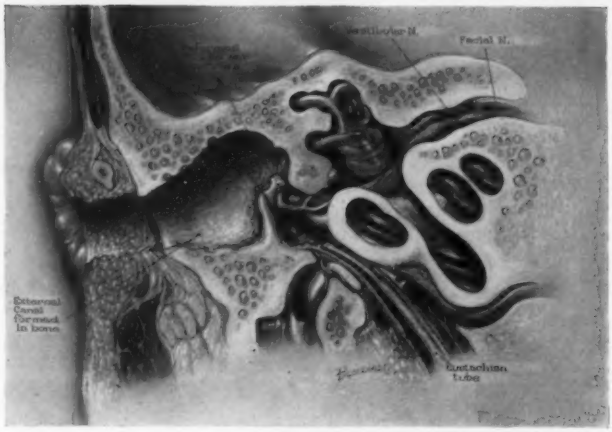
THE FOLLOWING ILLUSTRATIONS DEPICT THE SURGICAL TECHNIQUE USED IN THIS SERIES OF CASES:



Drawing I.
The Normal Auditory Mechanism.

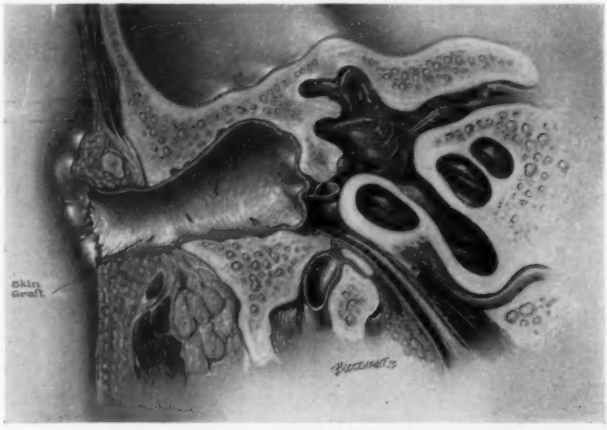


Drawing II.
Congenital Mictoria and Ear Canal Atresia.



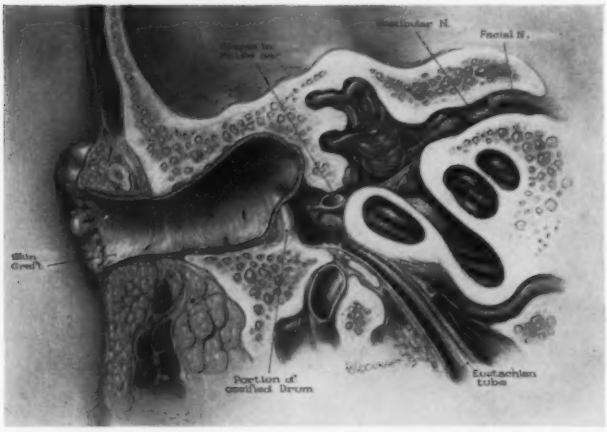
Drawing III.

A New Ear Canal is Created to the Level of the Bony Ear Drum by Means of the Dental Burr. Diffusion and Fixation of the Deformed Incus and Malleus to the Bony Ear Drum can be Visualized.



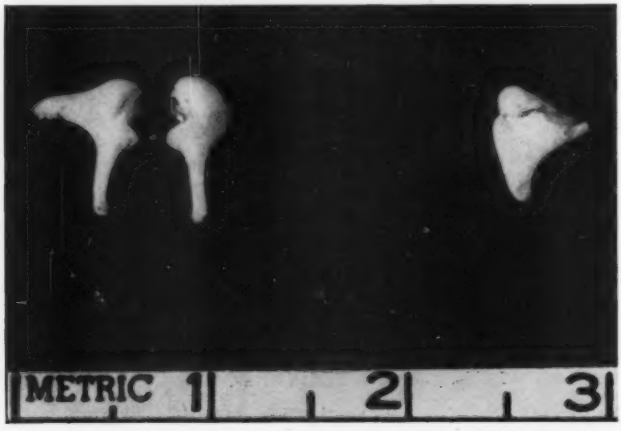
Drawing IV.

The Bony Ear Drum, Incus and Malleus have been Removed and a Skin Graft Applied. If this Technique is used, the Hearing Improvement is Minimized because the Graft lies over the Stapes Area and Results in Partial Fixation.



Drawing V.

The Procedure of Choice Leaves the Bony Ear Drum Largely Intact. The Deformed and Fixed Incus and Malleus are Removed through the Smallest Possible Attic Opening. A Thin, Full-Thickness Skin Graft is Placed over this Opening to act as a new Ear Drum Creating a Middle Ear Air Space and Avoiding Partial Stapes Fixation. A Maximum Hearing Improvement is Attained by this Technique.



Drawing VI.

Comparing a Congenital and Normal Incus and Malleus.

4. After exposure of the mastoid cortex, the location of the mastoid tip and zygomatic root is noted. If the mastoid is known to be well pneumatized, a large round cutting bur is used to remove the cortex in the region of the mastoid tip, thus exposing the air cells. These can then be superfically removed superiorly until the dural plate is encountered. The antrum may then be entered and the horizontal canal identified taking care to approach this area from the posterior aspect.

5. If the mastoid is known to be sclerotic, the problem is much more difficult. A large round cutting bur is used, and the cortex is removed superior and posterior to the zygomatic root. In this way the approach is superior to the mastoid region, and dura is uncovered immediately under the cortical bone of the skull. The dura is then followed inferiorly until it descends to form the dural roof of the mastoid cavity. This dural plate is followed posteriorly until the sinodural angle is encountered. This angle is then followed anteriorly, inferiorly, and deep, directly to the bony labyrinth and the horizontal canal.

6. The region between the dural plate and the horizontal canal is followed anteriorly until the deformed ossicles are visible. Care is taken to avoid undue exposure of the bony ear drum, and very little bone is removed toward the glenoid fossa in the area where the normal ear canal should ordinarily exist. The entire approach to the deformed ossicles is in a posterior to anterior direction through the epitympanum in order to avoid undue exposure of the middle ear region. As Pattee stated, the opening should be as small as possible, and I will add, as far away from the stapes as possible.

7. If the long crus of the incus can be severed from the stapes, or the incus can be removed without the malleus, a still smaller opening into the middle ear may be made and the graft kept still further from the stapes region.

8. The deformed ossicles should be removed by rotating them anteriorly and superiorly. The stapedius tendon provides counter traction, and one is less likely to evulse the stapes from the oval window by using this technique.

9. At this point, the cavity is packed with 1:1000 epinephrine to control bleeding and the skin grafts are prepared:

(*a*) An elliptical, thin, full-thickness skin graft 1.0 x 2.0 cm. is taken from the postauricular area. It is thinned by scissors to eliminate glands and hair follicles and perforated to allow blood serum to escape after being placed in position. The wound behind the ear is then undermined and closed.

(*b*) A split skin graft is removed from the thigh for lining the remainder of the cavity.

10. With a magnifying loupe, blood is floated into the epitympanum to provide a bed for the thin, full-thickness graft as it is placed over the small opening leading to the middle ear. This graft now lies parallel to the length of the newly created ear canal and covers the attic opening thereby creating a middle ear space and avoiding the middle ear area and stapes region. This thin, full-thickness graft holds this shape and position and the incidence of "take" is extremely high. Why this thin, full-thickness graft takes over an opening and does not tend to retract can be explained only by the apparent development of a mucous membrane lining from the middle ear region or by transverse collateral circulation. I have used this same type of graft to cover the Eustachian tube orifice in radical mastoid cavities for many years and more recently to repair certain cases of ear drum perforations with equal success.

11. If the stapes is found to be fixed after removal of the deformed ossicles, a fenestration should then be performed in the usual location and a split skin Thiersch graft placed into position, as reported by Ombredanne, Vogel, Siirala, and others. If any question as to fixation exists, a two-stage procedure as advocated by Woodman is the procedure of choice.

12. The split skin graft, cut into segments to fit the mastoid cavity carefully, is placed into position under magnification. Small pledgets of rolled cotton moistened in saline are used to maintain an equalized constant pressure over the

graft. Twenty to thirty such pledgets may be necessary in each case. The split skin grafts are sutured to the skin edges, and the external opening pressure maintained by a strip of parresined gauze. The patient is returned to surgery on the sixth postoperative day and under anesthesia and magnification, the cotton pledgets are removed together with the external sutures. More recently the delayed split skin graft technique, as advocated by Guilford[23], has proven very satisfactory in applying grafts to the postoperative cavity.

POSTOPERATIVE CARE.

1. Antibiotic therapy, prophylactically, is given during the patient's eight-day hospital stay and for one week thereafter.

2. The patient is very thoroughly indoctrinated just as in our radical mastoid cases *not to blow his nose* but to drain any accumulation into the throat, for three months postoperatively. Should he sneeze, he should do so with the mouth open and with a finger tightly occluding the external canal.

3. The healing cavity is not disturbed, and only a puff of terramycin powder is occasionally instilled. Completely sterile technique with gloves is used routinely in all our ear cases for one month postoperatively.

4. A hollow acrylic mold is fitted to the newly created ear canal three weeks after surgery. This is used for three or four months postoperatively until all tendency to healing contracture has been eliminated.

5. Just as in all our ear surgery, if evidence of secondary suppuration develops, cultures are made and sensitively tests to various drugs carried out. The drug of choice is then used both locally and internally to combat the infection.

6. Solid acrylic molds are fitted in all cases after complete healing, and the patient is told to insert them with vaseline to keep water out of the ear during showers and while shampooing the hair, as a precautionary measure.

7. If plastic repair of the deformed pinna is not desired by the patient, artificial auricles consisting of vinyl plastic

are created. Several pair may be needed to conform with the seasons of the year and, in my experience, these have proven quite satisfactory. In one case, the cupping effect of artificial auricles increased the hearing an average of six decibels in the speech frequencies and enhanced the discrimination score from 8- to 88 per cent.

CASE REPORTS.

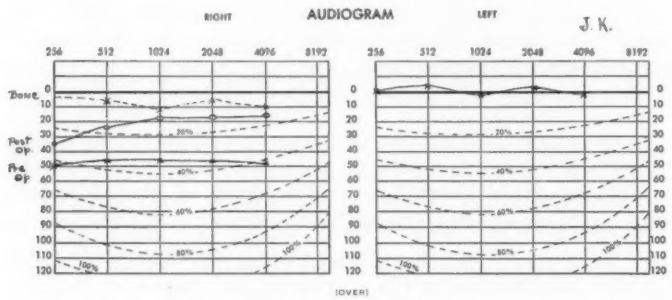
Case No. 1: Miss J. K.—Age 19 years. *History:* Patient discovered a hearing impairment in her right ear accidentally at the age of eleven years. This impairment has remained stationary since discovery. There has been no history of ear infection.

Findings: The ear canal and ear drum appeared essentially normal and the eustachian tube was patent. X-ray studies revealed a well pneumatized mastoid with ossicles visualized in the epitympanum.

Diagnosis: A tentative diagnosis of unilateral otosclerosis, or a congenital deformity was established. The lack of progression favored a congenital abnormality.

Surgery: On June 15, 1951 an exploratory endaural mastoidectomy was performed. The short crus of the incus was found to be fused to the annular ring by a small lip of bone. The incus and malleus were otherwise normal. The short crus of the incus was carefully freed from the annular ring, thereby allowing mobility of the ossicles. The stapes was noted to be freely movable and a skin flap was then placed over the freed ossicles. A fenestration was not performed.

Results: This patient gained serviceable hearing in the operated ear, which was most important to her musical career.



Audiogram. Case 1.

Preoperative Level	6/14/51	45 db.
Postoperative Level	12/27/51	18 db.
Gain		27 db.

Case No. 2: Mr. G. M.—Age 20 years. *History:* Patient has a bilateral congenital ear canal atresia with marked deformity of the auricles.

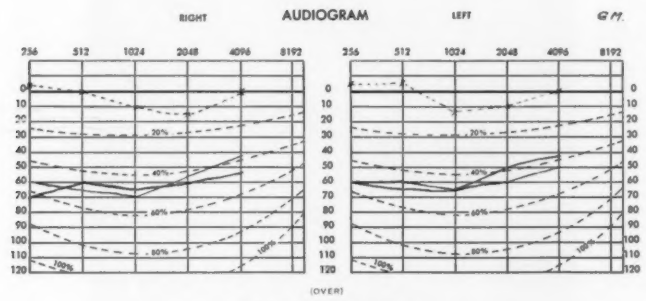
Findings: X-Ray studies by the Owen technique revealed both mastoids to be completely sclerotic without evidence of ossicles in either middle ear. Audiograms revealed a bilateral conduction type of hearing impairment.

Diagnosis: The diagnosis of bilateral congenital ear canal atresia with a conduction hearing impairment was established.

Surgery: On November 2, 1949 a right modified Pattee procedure was performed. The mastoid was completely sclerotic and the epitympanum and middle ear space with the contained ossicles could not be demonstrated. A fenestration was not performed.

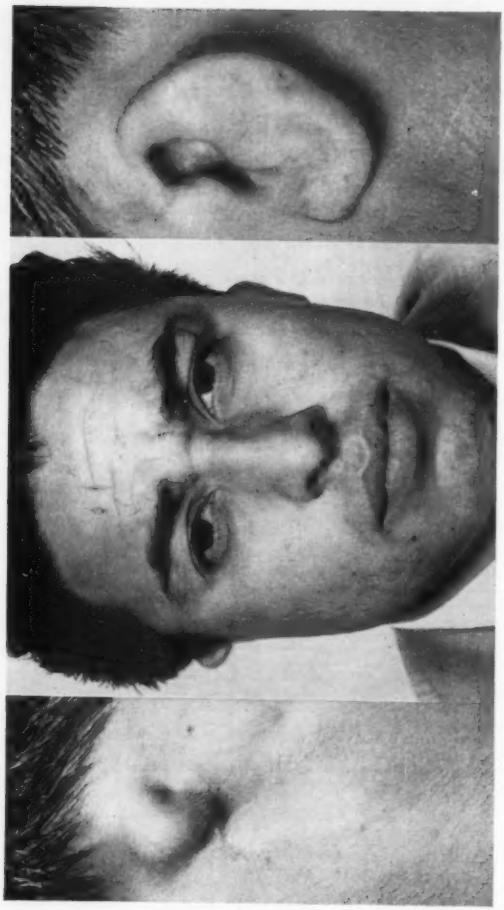
On June 15, 1950 a left modified Pattee was performed and again the mastoid was found to be totally sclerotic without evidence of a middle ear space, or ossicles. A fenestration likewise was not performed.

Results: Since the procedure could not be completed, the patient failed to obtain any hearing improvement from either operation. He is wearing a hearing aid at the present time and does not wish to consider a fenestration operation.



Audiogram. Case 2.

Right Ear		*Left Ear*	
Preoperative Level..9/21/49	63 db.	Preoperative Level..3/25/50	58 db.
Postoperative Level.7/ 7/50	62 db.	Postoperative Level.7/ 7/50	63 db.
Gain	1 db.	Loss	5 db.



Case 2.

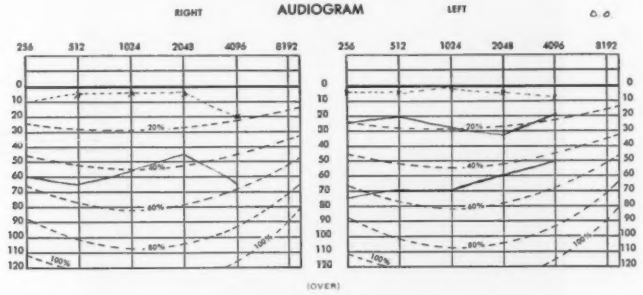
Case No. 3: Miss O. O.—Age 8 years. *History:* This patient was born with deformed auricles, but could hear well with a hearing aid.

Findings: Patient had a completely bilateral bony ear canal atresia with marked deformity of the auricles. X-ray studies revealed both mastoids to be well pneumatized with the incus and malleus readily visualized. Audiometric studies revealed a bilateral conductive type of hearing impairment.

Diagnosis: The diagnosis of a bilateral congenital ear canal atresia with a middle ear and ossicles was established.

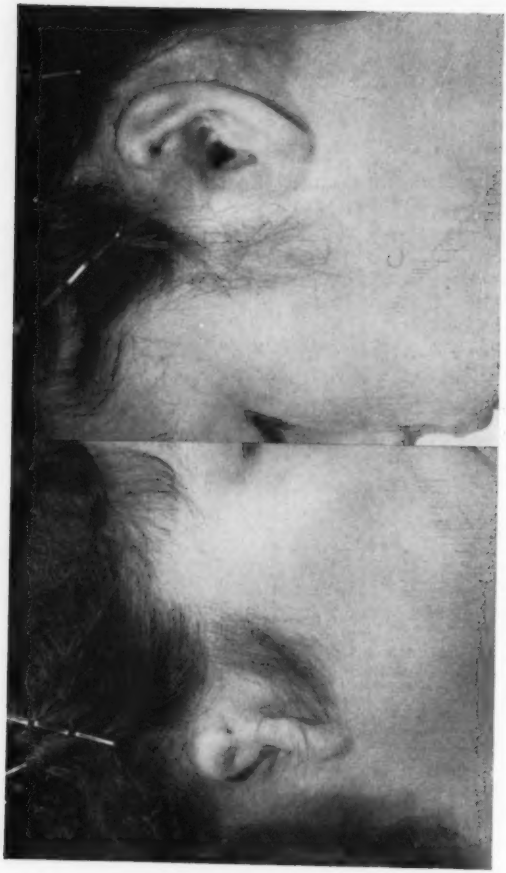
Surgery: In May, 1948 a left modified Pattee procedure was performed. The mastoid was found to be well pneumatized, and the incus and malleus were fused and deformed. These were removed revealing an underlying mobile stapes. A full thickness graft was placed over the attic area, sealing the middle ear space. The remainder of the cavity was lined with a split skin graft.

Results: The patient gained serviceable hearing and has maintained this level to date.



Audiogram. Case 3.

Preoperative Level....3/ 8/48 66 db.
Postoperative Level...3/16/49 27 db.
Gain .....39 db.



Case 3.

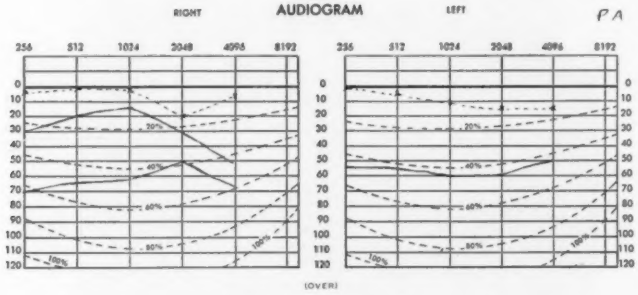
Case No. 4: Miss P. A.—Age 11 years. *History:* Patient was born with a bilateral ear canal atresia with considerable malformation of the auricles.

Findings: Patient had evidence of a pure conduction type of hearing impairment. There was considerable asymmetry of the face showing evidence of a Teacher-Collins syndrome. X-ray studies revealed the mastoids to be well pneumatized with ossicles present in both middle ears.

Diagnosis: The diagnosis of bilateral congenital ear canal atresia with a middle ear space and ossicles was established.

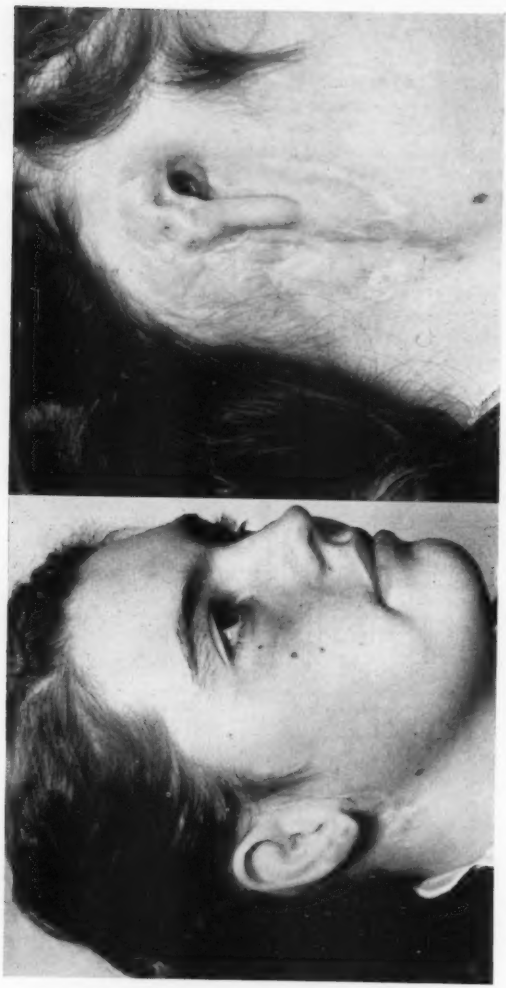
Surgery: On July 12, 1950 a right modified Pattee procedure was performed. The mastoid was found to be well pneumatized with a fused and deformed incus and malleus, producing fixation of the stapes. The deformed ossicles were removed and a full thickness graft placed over the attic, sealing the middle ear space. A split skin graft was placed over the remainder of the cavity. A fenestration operation was not performed.

Results: The patient gained serviceable hearing which has been maintained to date.



Audiogram. Case 4.

Preoperative Level....4/26/50 60 db.
Postoperative Level...7/23/51 22 db.
Gain .....38 db.



Case 4.

Artificial auricles in place for cupping effect produced a 6 db average improvement in both ears.

Post-operative with acrylic mold in place. Note scarring due to attempted plastic repair performed in childhood.

Case 4.

Artificial auricle in place.

Unoperated ear revealing auricular deformity.

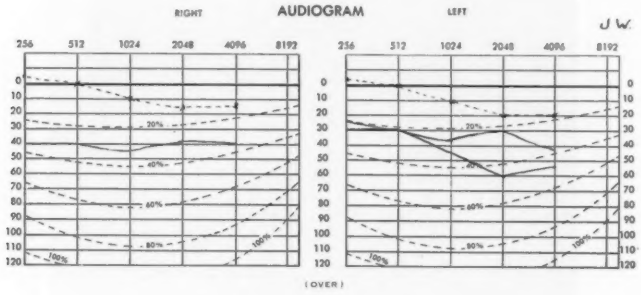
Case No. 5: Miss J. W.—Age 7 years. *History:* Parents noticed a hearing impairment at about two and a half years of age. A tonsillectomy and adenoidectomy was performed without improvement in her hearing. The child was born with a cleft palate.

Findings: Examination revealed normal auricles and a complete bony atresia of both ear canals. X-Ray studies revealed both mastoids to be well pneumatized with a middle ear space containing ossicles. Audiograms revealed a bilateral conduction hearing impairment.

Diagnosis: Bilateral congenital bony atresia of the ear canals.

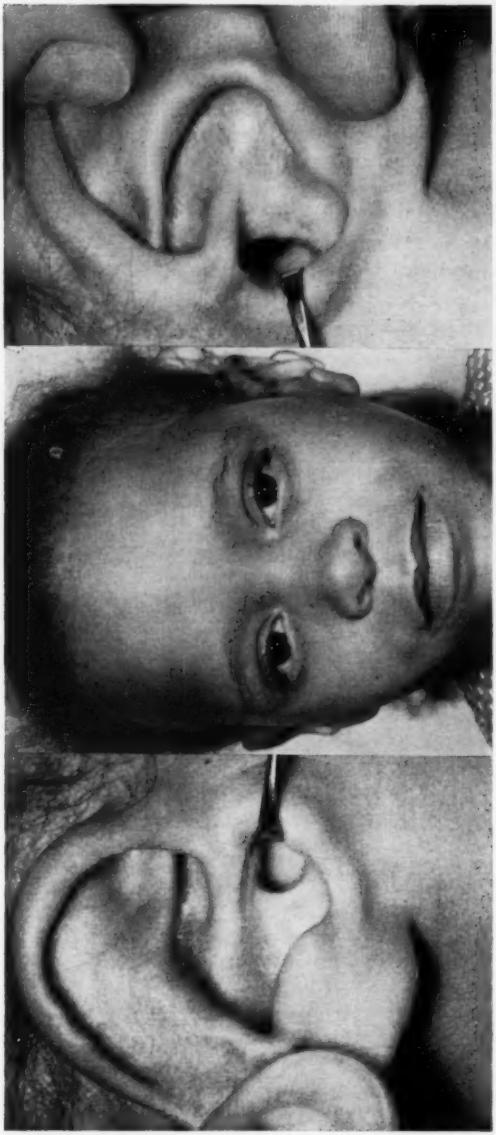
Surgery: A left modified Pattee procedure was performed in August, 1951. The mastoid was found to be well pneumatized. The ossicles were deformed, fused and fixed. Following removal of the incus and malleus, the stapes was mobile. A full-thickness graft taken from behind the ear was placed over the attic area, creating a sealed middle ear cavity. The remainder of the mastoid was lined with a split skin graft taken from the thigh.

Results: The patient's hearing improvement was not sufficient to gain a serviceable level and fenestration may become necessary.



Audiogram. Case 5.

Preoperative Level... 7/10/51 45 db.
Postoperative Level..12/26/51 32 db.
Gain .....13 db.



Case 5.

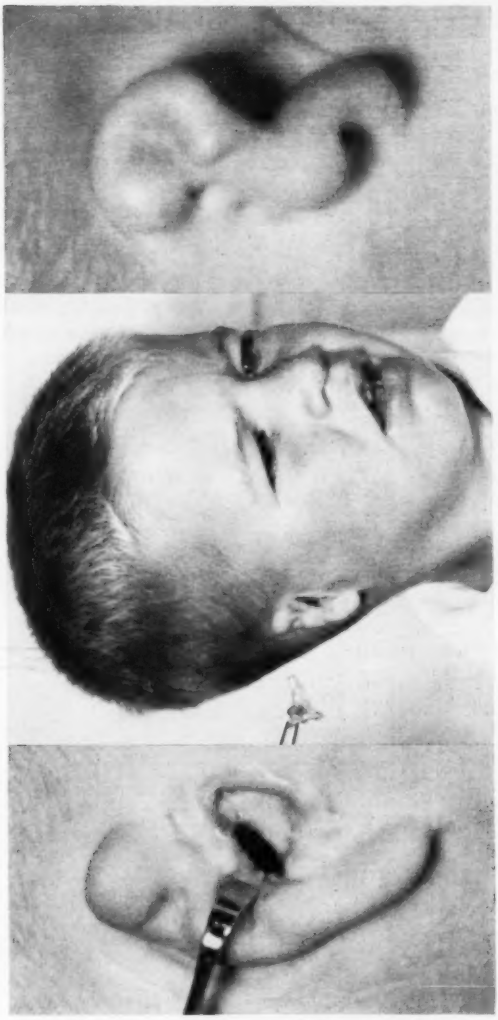
Case No. 6: N. McB.—Age 3 years. *History:* Bilateral ear canal atresia with malformation of the auricles and an associated hearing impairment.

Findings: Examination revealed complete atresia of the ear canals with malformed auricles. X-ray studies showed a well pneumatized mastoid with a middle ear space and ossicles. The child gave evidence of a conductive type of impairment, but audiograms could not be obtained prior to surgery.

Diagnosis: Bilateral complete congenital ear canal atresia with a middle ear space and ossicles.

Surgery: A modified Pattee procedure was performed on the right ear in June, 1951. The mastoid air cells were exenterated and a deformed and fused incus and malleus were removed. The stapes then became mobile. A full-thickness skin graft was placed over the attic area, thereby creating a middle ear space. A split skin graft was taken from the thigh and used to line the remainder of the cavity.

Results: Accurate preoperative and postoperative pure tone audiograms have not been recorded due to the child's age. Speech tests, however, indicate considerable hearing improvement as a result of the surgery.



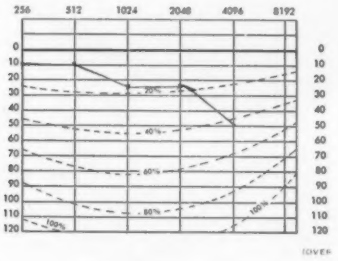
Case 6.

Case No. 7: D. G.—Age 4 years. *History:* The parents noted a lack of speech development and an apparent hearing loss at two and a half years of age.

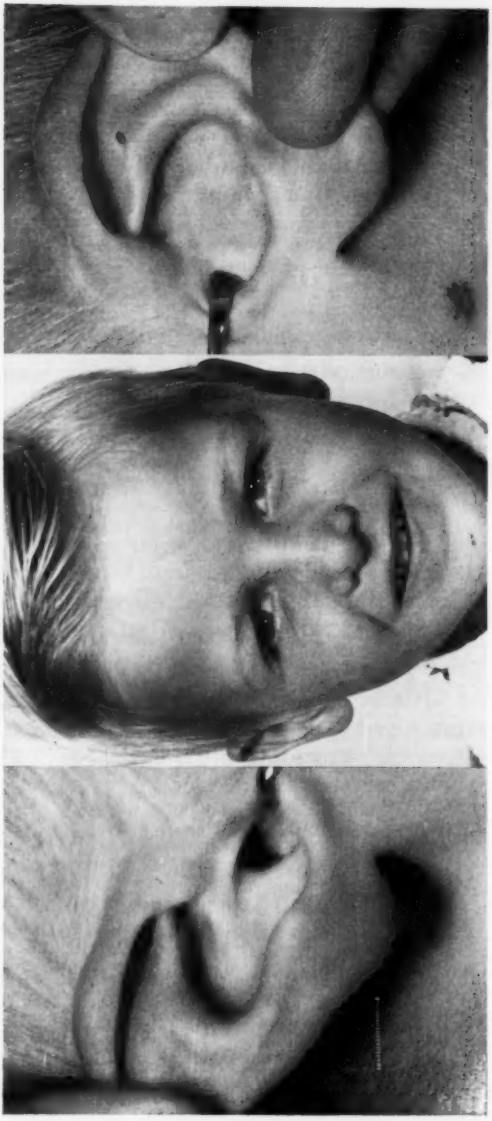
Findings: Both auricles were normal, but there was a complete bony bilateral congenital ear canal atresia. X-ray studies revealed a well pneumatized mastoid with a middle ear space containing ossicles. The child exhibited evidence of a conductive type of hearing impairment.

Surgery: A right modified Pattee procedure was performed on September 20, 1951. The mastoid was pneumatized, and the deformed and fused incus and malleus were removed. The stapes then became mobile. A full-thickness graft was taken from the postauricular area and placed over the attic, sealing the middle ear space. The remainder of the bony cavity was lined with a split skin graft taken from the thigh.

Results: Accurate audiograms are not obtainable, but his response to speech tests, as well as his development of speech since surgery, indicate an apparent satisfactory improvement in hearing.



Audiogram. Case 7.



Case 7.

SUMMARY.

1. Hearing restoration should take take precedence to plastic repair in all bilateral cases of congenital atresia.

2. Unilateral cases do not present an urgent hearing problem and surgery may be delayed until the individual is of age to decide the issue for himself.

3. Every effort should be made to create "sound awareness" while awaiting the determination of suitability for surgery.

4. Suitability for surgery is determined by

(1) X-ray confirmation of a middle ear and ossicles (Owen technique).

(2) Determination of good cochlear nerve function.

(3) The best age for surgical intervention seems to be three to four years.

5. A thin, full thickness graft placed over the smallest possible opening into the epitympanum to create a middle ear space and avoid scarring about the stapes region provides hearing improvement to the practical level in the majority of cases.

6. Fenestration is indicated immediately if stapes fixation persists after removal of the deformed ossicles. It is indicated as a secondary procedure if the initial hearing improvement does not reach the practical level.

7. The use of an acrylic mold seems to be imperative to prevent postoperative stenosis.

8. Due to anatomical variations the operation for congenital atresia is the most difficult surgical procedure performed on the temporal bone.

CONCLUSION.

This review of congenital ear canal atresia reveals the tremendous strides made in the surgery of these unfortunate

persons during the past decade. The progress made in the restoration of hearing in these cases is indeed a tribute to otologic surgery.

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1136 West Sixth Street.

ANATOMICAL AND PHYSIOLOGICAL CORRELATIONS ON STIMULATING THE HUMAN SUPERIOR LARYNGEAL NERVE.

JOSEPH H. OGURA, M.D.,* and
ROBERT L. LAM, M. D.,†
St. Louis, Mo.

The superior laryngeal nerve has been accepted as the principal sensory nerve supply of the larynx. Less significant autonomic and motor functions have been ascribed to a small portion of the nerve. No previous experimental study has been conducted on the human superior laryngeal nerve to correlate specific modalities of sensation with its specific evoked action potentials and histologic characteristics of fiber components. Such information may provide a basis for a better understanding of the sensory functions of the larynx, particularly in reference to reflex secretions and reflex closure of the vocal cords.

Experimental data for such a study was available in patients with carcinoma of the larynx, considered as candidates for laryngectomy and radical neck dissection. The readily accessible superior laryngeal nerve could be stimulated in situ and clinical observations recorded. Subsequent removal of the nerve to a stimulating chamber permitted an electro-physiological study of the evoked action potentials. Finally, fixation and impregnation of the nerve provided detailed information as to fiber size and degree of myelination.

METHOD.

A. The patients for operation and superior laryngeal nerve study were carefully screened as to dependability and accuracy

*Department of Otolaryngology, Washington University School of Medicine, St. Louis, Mo.

†Department of Neuropsychiatry, Washington University School of Medicine, St. Louis, Mo.

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in reporting clinical phenomenon. The details of the procedure were discussed with each patient the evening before surgery. Four cases were studied and in all instances the cooperation was excellent.

The usual preoperative medications were omitted, except for one and one-half grains of nembutal two hours before surgery. Local anesthesia consisted of one per cent novocaine containing twelve drops of 1/1000 adrenalin per ounce. Less than 15 cc. of the local anesthetic agent were used. The novocaine-adrenalin was injected superficially only at the points of exit of the greater auricular, greater and lesser occipital and superficial cervical cutaneous nerves at the posterior border of the sternocleido-mastoid muscles. No anesthesia was used in the anterior triangle or the deep structures in the neck.

The usual "U" flap incision was outlined with methylene blue from one mastoid process to the other along the posterior borders of the sternocleidomastoid muscles, with the horizontal arm one finger breadth above the suprasternal notch. The skin flap was elevated superiorly deep to the platysma to approximately the angle of the mandible and just above the hyoid bone.

In order not to interfere with the "en bloc" removal of the larynx and cervical lymph nodes, the superior laryngeal nerve contralateral to the primary local lesion was selected for study. To accomplish this, dissection was carried along the anterior border of the sternocleidomastoid muscle down to the greater cornu of the hyoid and extended superiorly and inferiorly just medial to the vascular sheath. The superior laryngeal nerve could easily be identified lying immediately superior and medial to the superior thyroid artery and superior to the greater cornu of the hyoid bone. The nerve usually accompanied the superior laryngeal artery, a division of the superior thyroid, to enter the thyrohyoid membrane about 2.5 cm. from the midline and equidistant from the hyoid and superior border of the thyroid cartilage. Meticulous care was exercised in dissecting the nerve, and only a small 2 cm. segment was exposed for stimulation. During the

entire experiment the nerve was carefully moistened with warm isotonic saline. The nerve was laid on a sterile stimulating silver hook electrode; suspended well above underlying soft tissues, which were covered by sterile, dry cellophane to insure against spread of current.

B. The superior laryngeal nerve was then stimulated by 1 millisecond single shock and repetitive shocks (Harvard Coil) of increasing intensities. With each increase of stimulus strength, the patient was asked to describe his sensations in terms of type, location, intensity and other associated phenomenon. The types of sensation considered were *touch, tickle, pain* (dull, aching, boring, burning, sharp, shooting) and *taste.* Location included area involved especially as to limits, laterality and spread, and midline relationships. Intensity was graded grossly as minimal, mild, moderate and severe or intolerable. Associated phenomenon were mucous secretory activity, swallowing, closure of the cords, and changes in respiration.

Immediately after recording the clinical observations derived from electrostimulation of the superior laryngeal nerve at the operating table, an approximately 6 cm. length of the nerve from the nodose ganglion to the thyrohyoid membrane was dissected and removed for evoked potential studies. Constant temperature (37 degrees C.) and moisture control was provided by a specially constructed stimulating nerve chamber. Silver stimulating and recording electrodes were separated by a large silver ground to minimize shock artifact. Stimulation was at the cathode and the distance between cathode and the proximal recording electrode was 4.0 cm. Single shocks of increasing intensities were delivered by a Thyratron, or by a Grass square wave stimulator, through an isolation transformer. Propagated nerve potentials were observed and photographed on the cathode ray oscilloscope.

C. On completion of the action potential studies, the superior laryngeal nerve was fixed in 15 per cent formalin, and stained with 1 per cent osmic acid. Cross-sections of the nerve (6 microns) were examined for fiber size and

degree of myelination; a total fiber count was then made and results tabulated. Another portion of the nerve was impregnated by the silver technique of Holmes and cut at 6 microns for unmyelinated fiber analysis.

RESULTS.

A. Single shock and repetitive shock stimulation of the superior laryngeal nerve in situ produced significantly different clinical responses reported by the patients. Intensities of stimulation will be arbitrarily referred to in units with 1 indicating threshold levels. Thus, at single shock stimulus strength 1, the patient experienced the first sensation of touch or tickle, located in the ipselateral deep areas of the "voice-box" and throat, extending to but not crossing the midline anteriorly, limited grossly by the mandible and the upper two or three tracheal rings. At slightly supraliminal stimulation of 1.25, a mild sharp pain was noted in addition to the predominant sensation of touch or tickle. Localization was the same. At 1.5 stimulus strength the pain became dull, severe, aching and completely superseded and masked the previous feelings of touch and sharp pain. Increasing intensities of applied current up to arbitrary units of 10 produced a commensurate increase in the severity of the dull aching pain to the point of intolerability; however, it was carefully observed that no new or different sensation was experienced with rising strengths of stimulation. In particular, the patient felt nothing suggestive of taste. No swallowing, coughing or closure of the vocal cords occurred with single 1 msec. shocks even at the maximum intensities of 10.

Repetitive shocks delivered at the rate of approximately 30/sec. for periods of about ¼ sec. elicited considerable differences in the modalities and phenomenon reported by the patient.

1. Pain assumed a burning, boring quality far more disagreeable and intolerable than the simple aching pain resulting from single shocks.

2. At stimulus strength of 8, associated with the above poorly localized severe pain, mucous secretions were noted in the "deep throat" regions, requiring frequent clearing of the throat and swallowing movements.

3. At stimulus strength of 9, a sudden abrupt closure of the vocal cords occurred producing a sharp audible clicking sound from the patient. Again, the same type of pain and mucous secretions with clearing of the throat were noted.

4. With the transition to severe, burning, boring pain, stimulation produced a brief transient period of apnea sometimes lasting as long as 30 seconds. The pain area was essentially the same as that outlined for single shock stimulation. No gustatory activity was elicited at any time.

B. Evoked potential analysis of the human superior laryngeal nerve revealed two characteristic waves: *1.* An initial 200 to 300 microvolt, 1.0 to 1.25 msec. response with a conduction rate of about 50 M/sec. This may be designated as the "A" wave (see Fig. 1, A). *2.* A considerably smaller

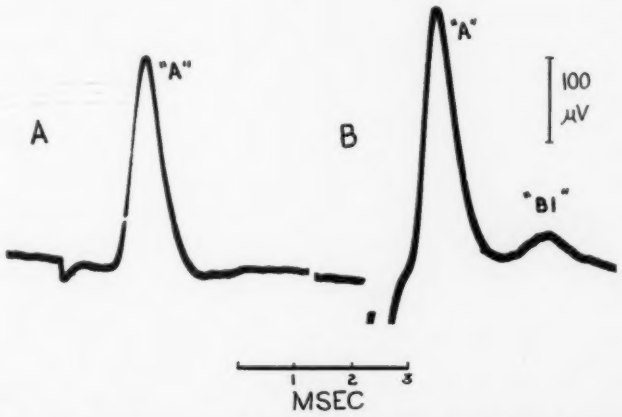
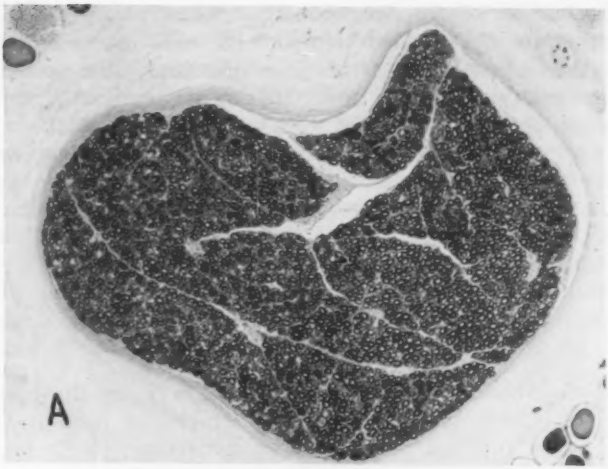


Fig. 1. Propagated nerve potentials on stimulation of the isolated human left superior laryngeal nerve (nerve chamber 37° C). A. Initial "A" response to slightly above threshold stimulus (0.9 volts). Conduction distance 4 cm. B. Compound "A" and "Delta" response to supraliminal threshold stimulus (6.0 volts). Conduction distance 4 cm.

30 to 50 microvolt, 1.0 to 1.25 msec. response with a conduction rate of about 15 M/sec. (see Fig. 1, B). This "B 1", or delta potential was propagated at a stimulus intensity 5 to 6 times greater than the threshold for the evoking of the earlier "A" response.

In continuing the potential analysis with the maximum stimulation possible, no third or "C" response could be obtained. Considerably higher voltages were used than those usually needed to elicit "C" waves from the experience of one of us (R.L.L.) in stimulating rabbit, cat or monkey vagus or saphenous nerves. Control stimulation of the cat superior laryngeal nerve in six experiments previously conducted under similar conditions revealed essentially the same potentials as these demonstrated for the human nerve.[1]

C. Histological study of the human superior laryngeal nerve with the osmic acid and silver techniques demonstrated clearly that the bulk of the nerve is composed of myelinated fibers, and only a very minor component is relegated to unmyelinated fibers. The nerve measured about 1.0 x 0.75 mm. in diameter and contained approximately 15,000 myelinated fibers (see Fig. 2, A). Silver sections examined under oil immersion showed about 1,000 unmyelinated fibers, arranged in groups of several small fascicles, each containing a hundred or more fibers, and scattered usually near the periphery of the nerve. Myelinated fibers ranged in diameter from 1.0 to 15.0 microns and showed a definite curve in distribution (see Fig. 2, B). Fibers 10 to 15 microns in size represented about 33 per cent or one-third of the total number of fibers in the nerve. In this group, the 10 to 12 micron fibers comprised three-fourths of the number of fibers considered as the larger myelinated units. Fibers less than 10 microns in diameter were 67 per cent or two-thirds of the total number of fibers in the superior laryngeal nerve of the human. In this major division of medium and small size fibers, the smaller (1 to 3 microns) predominated over the medium by a ratio of four to one.



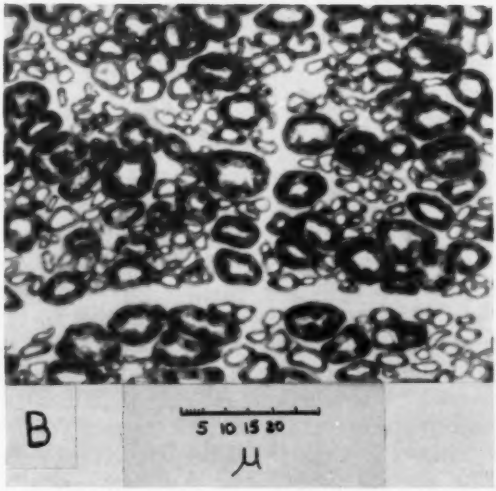


Fig. 2. A. Cross-section of human left superior laryngeal nerve 1.5 cm distal to the nodose ganglion. Note the uniformity of distribution of large and small fibers. Osmic acid (X 100). B. High power magnification (X 970) of representative section. The largest fibers measured 15 u in diameter. Note approximate division into large and small fiber components with few intermediate sized fibers.

Evaluation of the large fiber, medium and small fiber components of the human superior laryngeal nerve in terms of cross-sectional area, rather than unit population presented an entirely different picture. The large fiber group, representing about one-third of the total number of fibers in the nerve, occupied five-sixths of the cross-sectional area, while the medium and small fiber group, considerably larger in terms of unit numbers, actually filled out a relatively small portion or one-sixth of the cross-sectional area. This fact must be borne in mind when correlating with the voltages of specific action potentials of the nerve.

DISCUSSION.

Stimulation of the superior laryngeal nerve in the human subject clearly supported the well-established concept that the major function of that nerve is sensory. Both tactile and pain modalities, sharp and dull, were easily elicited with low threshold single shocks. Repetitive stimulation introduced the augmentation effects of temporal summation, and in all probability, excited other sensory fibers of higher threshold to produce the severe boring and burning quality not experienced with single shock stimulation.

The results on correlating function, action potentials and fiber size of the superior laryngeal nerve conform with the previous investigations on other somatic and autonomic nerves by Heinbecker,[2] Heinbecker and O'Leary[3] and Heinbecker, Bishop and O'Leary.[4] The "A" and delta potentials evoked on stimulation of the superior laryngeal nerve, and the low thresholds involved infer a correlation to touch and sharp pain mediated by the larger myelinated fibers (10-15μ). Sharp pain occurring at intensities of stimulation slightly above threshold for touch alone indicate that it is subserved by the fibers producing the initial "A" action potential. On the other hand, the slightly higher voltages to elicit dull pain suggest the participation of the delta group of myelinated fibers. The exact function of the delta fibers (3-4 microns in diameter and with conduction rate of about 15 M/sec.) cannot be accurately ascertained in the patient when

increasing strengths of stimulation are applied to the superior laryngeal nerve. The discharge of more and more medium size fibers may result in the production of a severe dull pain sufficient to mask the initial, less intolerable sharp pain, unquestionably related to the "A" fiber conduction alone, and also the pain conducted by delta fibers excited at higher thresholds; however, the change of the nature of dull pain to an intense boring and burning quality on repetitive stimulation, brings into consideration autonomic or "C" fiber pain of usually 1 M/sec. conduction rates. Although we could not elicit a "C" wave in our propagated potential studies, the demonstration of a small proportion of unmyelinated fibers by the silver method lends anatomical validity that the boring and burning pain could be viewed as visceral in nature. Our failure to show a "C" potential is probably due to the relative paucity of unmyelinated fibers in the superior laryngeal nerve of the human, or to the less than optimum conditions to evoke such a response in our experiments; however, the latter is not seriously entertained, as the delta wave is more frequently lost due to improper technical conditions and represents a more fragile response than the "C" wave. In the majority instances we were able to demonstrate a delta potential without difficulty.

Since the motor branch of the superior laryngeal nerve was stimulated along with the larger sensory trunk, undoubtedly much of the early phase of the "A" potential was due to the participation of the largest myelinated fibers innervating the cricothyroid muscle. The remainder of the "A" response and the delta wave correlated well with sensation mediated by the other myelinated fibers of the superior laryngeal nerve.

Gustatory functions have been attributed to the superior laryngeal nerve. The inability to show taste on stimulation of the nerve does not eliminate this possible function, as the overwhelming painful sensations could easily mask taste, unless the latter were particularly prominent.

The distribution of touch and pain elicited in our patients correspond well with the previous work of Onodi[5] and Hofer.[6]

In particular, the human studies of Hofer are confirmed except for exact boundaries in our experimental investigations. Hofer found a predominant unilateral supply in that the superior laryngeal nerve mediated sensation from the "Kehlkopfeingang" to the inferior margin of the vocal cord unilaterally in the larynx, and bilateral representation in a 2 cm. band in the midline, where terminal fibers of the two nerves decussate. The sensory functions of the inferior laryngeal nerve described by Hofer were not investigated in our experiments.

The production of mucous at high thresholds and repetitive stimulation was probably both direct and reflex in nature. Florey, Carleton and Wells[7] suggested a peripheral and reflex excitation in the production of tracheal mucous, although the superior laryngeal nerve was not stimulated. Johnson[8] showed secretory activity and mucous accumulation with direct stimulation of the peripheral and central ends of the cut superior laryngeal nerve. The technique employed in our studies afforded an opportunity for both mechanisms to elicit mucous.

Mucous secretory functions were probably subserved by the very small thinly myelinated and the unmyelinated fibers. Low intensity stimuli activating the larger fibers did not produce mucous sufficient to be detected by the patient. The paucity of unmyelinated fibers, and the relatively insignificant volume or cross-sectional area occupied by the smallest myelinated fibers, may account for our failure to demonstrate an action potential assignable to these fibers. Lemere[9] in his studies of the ramus anastomoticus ascribed secretory functions to the small myelinated fibers, considering them as preganglionic parasympathetic; however, in his work, as in that of previous investigators, no correlation was made between thresholds and observed or reported phenomenon. The high intensities of stimulation necessary to elicit secretory activity in our experiments compare well with those needed to excite thinly myelinated or unmyelinated fibers.

Apnea resulting from stimulation of the superior laryngeal nerve has been a common observation. Sjoblom[10] reported such findings in 1914. With graded stimuli, and most consistently with repetitive shocks, apnea noted in our patients was probably a reflex inhibitory phenomenon traversing afferent pathways via the superior laryngeal nerve to the reticular substance of the brain stem to impinge on efferent discharge centers. Andersson, Landgren, Neil and Zotterman[11] reported apnea on stimulating the cranial end of the cat superior laryngeal nerve as well as reflex augmentation of intestinal motility.

In a series of experiments to be summarized, we have found the first post-synaptic locus of potential maxima on stimulation of the central end of the superior laryngeal nerve of the cat to be the dorsal formatio reticularis rather than the visceral afferent nucleus of the vagus as anticipated. One of us (R.L.L.),[12] using the evoked potential method has demonstrated the principle post-synaptic locus in the visceral afferent nucleus on electrostimulation of the rabbit vagus; however, in this series of experiments, the afferent component of the superior laryngeal nerve was not stimulated. Thus, the finding that the sensory fibers of the superior laryngeal nerve project to the reticular substance suggests anatomical confirmation of the striking reflex functions that sensation in the larynx probably plays.

The abrupt closure of the vocal cords and swallowing movements on strong repetitive shock stimulation of the superior laryngeal nerve was again evidence of reflex activity mediated by the superior laryngeal nerve as the initial portion of the sensory arc to the brain stem reticular formation. Our observations on swallowing movements were also reported by Lemere,[9] and Andersson et al.[11]

From well accepted anatomical information, the efferent limb in the reflex chain resulting in mucous secretions, apnea, closure of the vocal cords, and deglutition, probably begin from a common synaptic pool in the formatio reticularis receiving afferent discharges from the superior laryngeal nerve. From this locus, efferent centers as the motor

nucleus of the vagus and nucleus ambiguus, are activated and final outgoing discharges are conducted by the vagus and the laryngeal nerves. Undoubtedly, the efferent arc becomes bilateral as decussation of afferent fibers occur in the brain stem. The same pathways are most likely traversed in the eliciting of augmentation of intestinal motility reported by Andersson et al.[11]

From our own experience on electrical excitation of the superior laryngeal nerve, this structure assumes considerable importance clinically in understanding laryngospasm and excessive mucous secretory activity. Any irritation of the laryngeal mucosa may precipitate reflex closure of the vocal cords, if such cause is of sufficient intensity or duration to produce stimulation of a large number of afferent fibers of the superior laryngeal nerve. Prolonged or severe excitation is present in many clinical situations where laryngospasm is most prone to occur: laryngoscopy with inadequate preoperative medication or topical anesthesia, laryngoscopy for foreign body without anesthesia, direct laryngoscopy for pain-producing lesions, where topical anesthesia is ineffective; introduction of suction tubes into the hypopharynx for excessive accumulations of secretions as in tetanus and bulbar poliomyelitis, and irritating sharp foreign bodies of the hypopharynx. The commonly observed excessive mucous secretions secondary to local irritative causes or to damage to the superior laryngeal nerve during thyroidectomy are likewise reflex in part, as a result of afferent stimulation.

CONCLUSIONS.

1. Electrostimulation of the human superior laryngeal nerve produced an activation of large and medium size myelinated nerve fibers associated with the propagation of an initial action potential of the "A" type, and the sensations of touch and pain.

2. Slightly supraliminal strengths of electrostimulation produced an activation of thinly myelinated fibers associated with the propagation of a second smaller action potential, delta or B_1 in type, and modality of pain.

3. Strong repetitive electrostimulation activated the smallest myelinated and unmyelinated fibers associated with severe deep boring and burning pain, mucous secretion, swallowing movements, sudden closure of the vocal cord and apnea. No action potential could be demonstrated to correlate with excitation of the smallest myelinated and unmyelinated fibers.

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EVALUATION OF HEARING LOSS IN DROP FORGE WORKERS.*

MEYER S. FOX, M.D.,
Milwaukee, Wis.

The concept that loss of hearing can result from exposure to loud sounds is not new. During the latter part of the nineteenth century, reports[1-3] were published dealing with braziers, blacksmiths, boilermakers, weavers and railroad men. Bunch,[4] following extensive investigations on this problem, reported his findings in 1937. He reviewed the previous studies, described the clinical observations, and predicated the medical, economic and social problems which would arise. During and since World War II, industry expanded, high speed machines were introduced, production increased greatly, and the resultant uncontrolled noise became more intense and more frequent. Hardy[5] pointed out that, "The emphasis in modern machine design has been to get more horsepower per pound and let the decibels fall where they may." In recent years studies were made by MacLaren and Chaney,[6] McCord,[7] Gardner,[8] McCoy[9] and Larson[10] in various industries. Their findings revealed that where noise was intense and sustained, hearing loss among exposed susceptible workers resulted. In spite of these findings, little attention was paid to the problem by either industry or workers.

The Committee on Conservation of Hearing of the American Academy of Ophthalmology and Otolaryngology, aware of the implications of this unharnessed force upon the hearing mechanism, appointed a subcommittee to investigate and study this problem. Under the leadership of the late Dr. W. E. Grove, numerous reports[11,12a,13,14,15a] and recommendations were made by this subcommittee. The inevitable medicolegal implications soon followed. In 1947, Nash[16a] reported a large

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series of cases in which claims for occupational hearing loss had been filed in the State of New York. Shortly thereafter, similar claims began to appear in many of the law courts of this country.

There are many factors which influence the degree of hearing impairment resulting from harmful industrial noise. Mentioned in order of their importance, they are as follows: *1.* The intensity and loudness of the noise; *2.* the period of exposure; *3.* frequency spectrum of the noise; *4.* individual differences in susceptibility; *5.* age of subject; *6.* distance from source; *7.* character of surroundings in which the noise is produced; *8.* previous and co-existing ear disease; *9.* position of each ear with respect to sound waves. These factors are discussed fully in the papers of Perlman,[17a] Shambaugh,[13] House[14] and Wheeler.[12a]

It is generally agreed that noise susceptible individuals, exposed to loud sound of sufficient intensity for long periods of time, will sustain some impairment of hearing, which may be temporary or permanent. Temporary hearing loss, designated by some as auditory fatigue, is a physiologic phenomenon. It is believed to occur in the hair-cells of the organ of Corti and may possibly be associated with chemical changes in the intralabyrinthian fluid of the inner ear. Wheeler[12a] refers to this phenomenon as a "temporary threshold shift." The permanent hearing loss is the result of degeneration and destruction of the sensory and neural elements of the organ of Corti. Secondary changes in the ganglion cells and nerve fibres also may occur. Guild[15b] observes, "Exactly how hair-cells are destroyed by acoustic energy is unknown; speculations at the present time would serve no useful purpose. It is known that with detonations hair-cells are destroyed suddenly, and with loud noises or tones the destruction occurs gradually. It is also known that, for any region of the cochlea, the outer hair-cells of the organ of Corti are more susceptible to destruction by acoustic trauma than are the inner hair-cells. The other epithelial elements of the organ of Corti are more resistant to acoustic trauma than are the hair-cells, but in

case of severe trauma destruction of all the epithelial elements may occur in the region of the cochlea, leaving only the basilar membrane intact in the affected region."

Symons[18] points out that there is a considerable difference of opinion as to the duration and intensity at which noise becomes hazardous. Intensities ranging from 80 to 130 db have been given as damaging levels. Glorig[19] best sums up the evidence with the following observation, "In general, we positively know that intensities of 130 db or more are damaging in a relatively short time; that in most cases 120 to 130 db will produce damage in time; that in many cases 100 to 120 db will produce damage in time; that in highly susceptible cases 90 to 100 db will produce damage and that intensities below 90 db will produce no damage. Damage is to be interpreted as a hearing loss in the speech frequency range." Moreover, as shown by Perlman,[17b] the deafening value of noise also depends upon its frequency spectrum as well as its intensity.

During the past two years (1950-1952), I examined a large group of workers who had filed claims for alleged loss of hearing due to industrial noise exposure. My studies covered 102 employees, among whom were 64 drop forge workers. These 64 men worked as hammermen, scalers, furnace operators or helpers in the forge shops. In these areas the intense noise arises chiefly from the impact noises of the drop forge hammers and the steady noises from the burners and blowers. Graphs based upon readings given by various measuring instruments for these two types of noise are shown in Figs. 1 and 2.

The noise which results from the impact of a drop-hammer is of a transient nature and is difficult to analyze by means of standard noise level meters and octave band analyzers. As stated by Williams,[20] measurement of these impact noises require "special attention because of the fact that the reaction time of the meter is longer than the time of impact." To obtain accurate readings of the sound pressure levels asso-

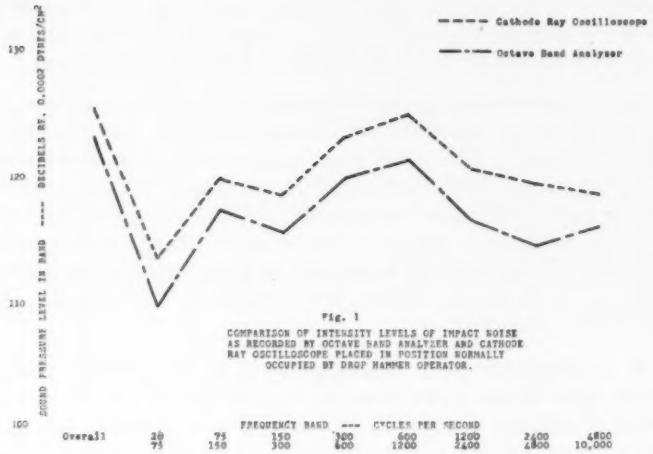

Fig. 1

COMPARISON OF INTENSITY LEVELS OF IMPACT NOISE AS RECORDED BY OCTAVE BAND ANALYZER AND CATHODE RAY OSCILLOSCOPE PLACED IN POSITION NORMALLY OCCUPIED BY DROP HAMMER OPERATOR.

Fig. 1.

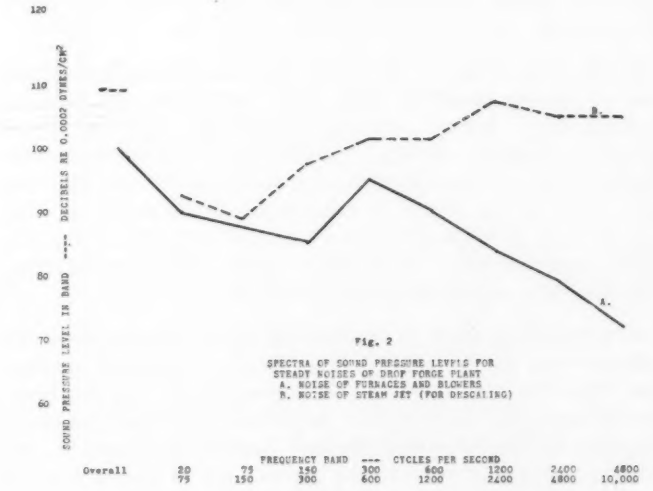

Fig. 2

SPECTRA OF SOUND PRESSURE LEVELS FOR STEADY NOISES OF DROP FORGE PLANT
A. NOISE OF FURNACES AND BLOWERS
B. NOISE OF STEAM JET (FOR DESCALING)

Fig. 2.

ciated with the impact noises of drop hammers, it is necessary to use a cathode ray oscilloscope, a sound level meter, and an octave band analyzer together with a high speed camera.

Fig. 1 shows a comparative study of the impact noises as measured by the standard octave-band analyzer and traced by the oscilloscope. It is noted that in this comparison, there was a spread of 5 to 10 db between the readings of the two instruments used. Williams[20] points out that the value obtained on a sound level meter may be as much as 25 db below the peaks recorded on oscillograph tracings. In these figures, the sound pressure is plotted in decibels with respect to a reference level of 0.0002 dynes/cm^2.

It is apparent from these figures that an analysis based solely upon meter indications is inadequate for the accurate study of impulse sounds. It is also apparent that the intensities of these sudden noises are sufficient to cause hearing loss among the exposed workers. It is also interesting to observe that the largest hammers did not generate the loudest sounds but that the intensity levels created by each machine's operation were rather dependent upon its construction and mode of operation.

The 64 drop forge workers who had filed claims for alleged loss of hearing resulting from their work had two or more examinations. Otologic, audiometric, and ear, nose and throat studies were made. Medical consultation was requested as indicated. One of the subjects was found to be malingering, while another was found to have psychogenic deafness. The hearing loss in these two cases was not included in the following analysis. The loss as found in the remaining 62 drop-forge workers is summarized in Table 1.

As revealed in Table 1, the hearing losses found among the workers were proportional to the length of time of employment. The ability to hear conversational voice, on the average, followed the audiometric determined hearing losses as computed on the American Medical Association formula. Individual variations were noted wherein there was a lack of correlation between the audiometric calculated loss and the

TABLE 1.

ANALYSIS OF HEARING LOSS SUSTAINED BY 62 DROP FORGE WORKERS.

Age Group	20-30	30-40	40-50	50-60	60-70
Number of Cases	6	13	24	11	8
Youngest	24 Years	31 Years	40 Years	50 Years	60 Years
Oldest	29 Years	38 Years	49 Years	59 Years	70 Years
Average	26.8 Years	35.2 Years	44.4 Years	55.2 Years	62.1 Years
Length of Employment					
Shortest	3 Years	4 Years	9 Years	8 Years	7 Years
Longest	8 Years	13 Years	25 Years	27 Years	27 Years
Average	5.5 Years	9 Years	14.4 Years	14.5 Years	20.4 Years
Loss Based on A.M.A. Formula*					
Least Loss	2.4%	2.5%	13.5%	13.8%	18.6%
Greatest Loss	33 %	58 %	77 %	62.6%	75.6%
Average Loss	17.7%	20.5%	37.2%	37.8%	49.6%
Ability to Hear Conversational Voice of Examiner at 20 Feet					
Maximum	17 Feet	20 Feet	14 Feet	13 Feet	8 Feet
Minimum	5 Feet	6 Feet	2 Feet	2 Feet	0 Feet
Average	12 Feet	11 Feet	7.2 Feet	6.9 Feet	4.1 Feet

*Tentative Standard Procedure for Evaluating the Percentage Loss of Hearing in Medicolegal Cases: Report of Council on Physical Medicine, Jour. A.M.A., 133:396-397, Feb. 8, 1947.

ability of the worker to hear speech. Workers in the fourth and fifth decade of life showed nearly equal hearing losses.

This is explained by the observation that their average years of employment in the drop forge plants were nearly identical. It further emphasizes the fact that in this group it is the number of years of exposure, rather than the age, which is significant. Forty-two of the workers complained of tinnitus. Six cases experienced fullness of the ears. Hearing aids were worn by three patients, two of whom had unsatisfactory results. Eighteen men gave a history of military service. Three workers had previous head injuries. Five subjects had a history of ear disease. In no instance was vertigo present.

The diagnosis of industrial hearing loss in these cases was based upon the following criteria: *1.* record of employment in areas of intense noise levels; *2.* medical history; *3.* objective findings. The previously described analytical studies indicated that intense noise levels were present in the forge plants. In reviewing the medical histories of these cases, it was found that there were no records pertaining to pre-employment hearing or ear studies. This was particularly embarrassing in view of the fact that most of the employees had been given routine pre-employment physical examinations; therefore, it became necessary to rely on the applicants for the history pertaining to past hearing impairment or ear disease. In a few instances, records from school or military service were obtained. The extent of hearing impairment claimed by the workers varied considerably. Some had trouble only with high frequency sounds like the ring of the telephone and doorbell or the ticking of their watches. Others complained of being able to hear, but not clearly; while some had marked difficulty in hearing any speech.

The clinical examination failed to reveal any local pathology of the ear canal, eardrum or nasopharynx. Some of the early cases showed only a slight or moderate dip at the 4,000 cycle frequency, as tested on the audiometer. Moderate and severe losses revealed involvement of the speech zone range of various degrees with greater losses in the higher frequencies. In

all cases the Rinne test was positive and bone conduction was decreased. Usually the hearing impairment affected both ears to the same extent. Whenever marked differences between the two ears were found, nontraumatic causes had to be ruled out. While the hearing losses in some cases were severe, total loss was not found. This is similar to the experiences of Guild[15b] and Nash,[16b] who stated that they had never observed total deafness resulting from industrial noise exposure.

The recruitment test has been used in the diagnosis of noise induced hearing loss. It is claimed that recruitment is present in these cases, its absence indicating hearing loss due to other causes. The binaural loudness balance test (Fowler[21]) or the monaural method described by Lüscher[22] can be used. The presence of recruitment explains why so many of the hard-of-hearing workers are unable to wear a hearing aid with satisfaction. Day[23] says, "they need clarity rather than amplification of sound." After reviewing numerous reports on recruitment, Lindsay[24] summarized as follows, "Further observations in a wider variety of types and degrees of deafness is essential in order to evaluate the significance of the recruitment phenomenon."

Many problems arose in the medicolegal evaluation of hearing loss found among the drop forge workers. Part of the difficulty was due to the absence of records which would have indicated the hearing status of the worker at the time his employment began. Most of the men claimed they had good hearing when they started work in the drop forge shops. Another difficulty for the examiner was to interpret the audiometric pure tone losses in terms of percentage disability for capacity to hear speech. This is not an easy task.

For years many methods were used to estimate loss of hearing in terms of percentages. This was accomplished by means of the whisper and conversational voice, ticking watch, tuning fork and audiometric tests. The lack of uniformity in these methods and their results was generally unsatisfactory. In 1942, the American Medical Association, through its Council on Physical Medicine and Rehabilitation, published the Fow-

ler-Sabine Method, more commonly known as the "A. M. A. Formula." It was revised in 1947. This is a weighted audiometric chart wherein each frequency is assigned a specific value. This chart is used by most otologists. H. A. Carter,[25] in a recent progress report, stated that the inadequacy of the methods commonly used for estimating the degree of hearing loss had been brought to the attention of the otological profession and of the Council of Physical Medicine and Rehabilitation. He pointed out that a joint subcommittee of these two groups was studying new methods for evaluating hearing loss in medical legal cases. At the October, 1952, meetings of the American Academy of Ophthalmology and Otolaryngology, it was announced by the above mentioned joint subcommittee that hereafter calibrated speech audiometry should be used for evaluating hearing loss in medicolegal cases. The Nov. 15, 1952, issue of the *American Medical Association Journal* published minimum requirements for acceptable speech audiometers.[26]

In my cases of the drop forge workers, the percentage of hearing loss was determined from the pure tone audiometric studies calculated on the American Medical Association hearing disability table. Reviewing my experiences, it would be advantageous to eliminate the 4,000 cycle frequency from the chart and assign its percentage value to the frequencies between 500 and 3,000 cycles per second. In addition, frequency losses of less than 20 db should have no compensatory value since they constitute very little handicap in hearing ordinary conversation.

Several hearing examinations were made of each worker in order to obtain accurate readings. Where variations occurred in closely spaced audiometric tests, the best findings were used as an indication of the worker's ability to hear. In no cases were averages used as a basis for computing the loss.

It is generally agreed that hearing acuity diminishes with advancing age; therefore, the consideration to be given the age factor in these cases becomes important. Deductions to compensate for the age factor were based on the World's

Fair,[27] San Diego County Fair[28] and U. S. Public Health[29] surveys. These studies indicate that the loss is not too significant until the age of 50 is reached. In the 50 to 60-year group, the average loss attributed to presbycusis amounts to 5.6 per cent, based on the American Medical Association hearing loss chart. After age 60 the loss is somewhat higher.

Determination of the permanency of the hearing in these cases is difficult under existing conditions. Most of these workers remain employed in the noisy environment responsible for their hearing loss. In view of this situation, I have accepted the opinion of the Subcommittee on Noise in Industry[18] pertaining to permanency of hearing loss. This opinion is based on a conclusion that, "Hearing loss produced by prolonged exposure to loud noise may be considered as permanent six months following complete removal of the individual from the area of loud noise." Large scale follow-up examinations of workers who have left the industry will be necessary to establish more definite conclusions as regards permanency of the loss.

SUMMARY.

This survey attempts to evaluate the findings of a large group of noise-induced hearing loss claims among drop forge workers. It should be remembered that this study cannot tell the complete story of this type of hearing loss. It is apparent that there is a need for basic investigation in the forge plants and among the workers. The otologic and hearing status of the worker will have to be studied at the time he begins employment, and should be followed through periodically. Functional relationships between the exposure factors and the hearing loss will have to be determined as well as the effectiveness of methods used to reduce noise intensity. The medicolegal problems which confront the otologist indicate that the authorized scientific bodies now investigating the various aspects of industrial hearing loss will have to revise and modify presently used formulas and methods of evaluating functional hearing.

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NEWCOMB AWARD OF THE AMERICAN LARYNGOLOGICAL ASSOCIATION.

Dr. Frederick T. Hill, Waterville, Maine, has been honored with the Newcomb Award by the American Laryngological Association, for his scientific contributions to that Society, his great service as its Treasurer, and his distinguished service to American laryngology during these many years.

Dr. Hill is also President of the American Otological Society.

MIXED TUMORS OF SOFT PALATE AND PAROTID GLAND. CASE REPORT.

WILLIAM WESLEY WILKERSON, JR., M. D.,
Nashville, Tenn.

CASE REPORT.

Although aberrant islands of salivary gland tissue are common congenital anomalies, mixed tumors involving such salivary tissue are less frequent.

In the case herein reported there was a large multilocular mixed tumor of the soft palate connected with a co-existing mixed tumor of the parotid gland.

PAST HISTORY.

The patient, Mrs. J. T. P., age 75, gave the history of having had a mass in the left parotid region and in her throat for eight years. Seven years previously a general surgeon had attempted to remove a tumor of the pharynx and that of the left parotid gland through an intraoral incision. His failure was evident from his operative notes: "A very large nodular tumor filled the entire left pharynx and posterior margin of the tumor extended back of the styloid process. The operator made an attempt to deliver the tumor outside the operation wound, but it was incarcerated between the inferior maxilla and the mastoid process. In attempting to deliver the tumor, it was ruptured and the entire contents of the tumor capsule extravasated into the operation wound. All visible pieces of tumor tissue were sponged away and what was considered all of the capsule was removed. After the removal of the tumor, almost the entire parotid gland had been freed from the surrounding structure. Incision in the margin of soft palate and pharynx loosely closed with three interrupted catgut sutures. The appearance of the tumor was quite characteristic of mixed tumor of the parotid

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region. The operator feels quite certain that all of the tumor was liberated, but he is not, of course, sure that a small portion of the tumor tissue did not remain in the wound as a free transplant."

PATHOLOGY.

"GSC—Five small pieces of irregular friable pale tissue.

MS—Reveals a loose areolar stroma in which are found collections of epithelial cells of irregular shape. Myoepithelial cells are also present. The granular cytoplasm is eosinophilic. There are areas of pink amorphous homogeneous material in nests of flattened epithelial cells. Myxomatous degeneration is noted in some areas.

DIAGNOSIS: Mixed tumor."

PRESENT HISTORY.

The patient stated that she had recently encountered difficulty in swallowing. Although she had no pain, a sense of fullness was present in the mouth. She had had irritation in the region of the hard and soft palates, particularly in the left side of her mouth.

CLINICAL EXAMINATION.

Upon examination a freely movable firm mass, the size of an unshelled almond, was found in the soft palate located primarily to the left of the midline. The left parotid gland revealed a neoplastic enlargement. Neither tenderness nor evidence of an inflammatory reaction was elicited during the examination and palpation of either tumor.

Clinically the tumors were diagnosed as recurrent mixed tumors. An ear, nose and throat examination showed no evidence of metastasis; the laboratory examinations were negative; a roentgen examination of the skull revealed no abnormalities; and a general physical examination was essentially negative.

Surgery of the throat and neck was advised, but the patient refused to have the tumor of the parotid gland removed as she stated that it was giving her no trouble. She consented, however, to the removal of the tumor of the soft palate.

SECOND OPERATION.

Under general anesthesia a linear incision was made 3.0 cm. long, on the left side of the soft palate, extending from 1.0 cm. from the midline to the angle of the jaw. Three masses were found lying just beneath the mucous membrane, freely movable, firm, encapsulated and yellowish-white in color. The three lobes of the tumor were distinct masses connected by strands of tissue. The same type of strand connected the larger lobe of the tumor with the parotid gland. Enlargement of the soft palate was noted medially to the masses, but no new growth was seen or palpated in this area. Digital examination of the nasopharynx revealed no new growth. Dissection was begun near the midline working toward the angle of the jaw. The attachment or pedicle of the tumor was severed near the parotid gland.

PATHOLOGY.

Gross Examination.

"The specimen is a tumor mass from the soft palate. The main mass of the tumor is well encapsulated. Associated with this portion are two distinct lobules of tissue which are soft and which appear to be connected to the tumor capsule by relatively loose areolar tissue. The entire mass measures 2.0 x 2.0 x 1.5 cm. On cross section the encapsulated portion appears as a firm, yellowish-pink homogeneous tissue. The remaining lobules are soft, translucent somewhat yellow in color, and suggest lymphoid tissue in their gross appearance."

MICROSCOPIC PATHOLOGY.

"The tumor is well circumscribed, surrounded by a thick fibrous capsule and made up of cords and masses of epithelial

cells embedded in hyalinized connective tissue stroma. Cells vary somewhat in size and shape but show none of the criteria indicating malignancy. Focal areas in the stroma show myxomatous changes, but nothing resembling cartilage is seen in the sections examined. In some zones the cells present an adenoid or cribriform pattern and appear to be elaborating the mucinous and hyaline material lying between cell groups. The tissues regarded in the gross as lobules of tumor prove to be separate masses of salivary tissue, normal in appearance. The glands here are primarily of the mucus type. Diagnosis: Mixed tumor."

SURGICAL RESULT.

The patient is in good health twelve months after the the second operation; the tumor of the parotid gland is approximately the same size, and there has been no recurrence in the soft palate.

CONJECTURES.

It has been stated by many authorities, and generally accepted, that a mixed tumor, unless completely removed may undergo malignant changes with necrosis and inflammation of the surrounding tissue. Yet seven years after a partial removal of this tumor, no evidence of such changes was seen. The pathologist's diagnosis after each operation was that of mixed tumor. Is it possible that the tumors removed were, on each occasion, adenolymphomas rather than mixed tumors?

Could it be that an encapsulated mixed tumor was completely removed at the first operation, and that an additional island of salivary tissue in the soft palate underwent metaplasia? As stated above, the pathologist found two aberrant islands of normal salivary tissue following the second operation.

Despite all theories to the contrary, could the soft palate have been invaded from a mixed tumor of the parotid glands

in such a bizarre manner? Did the second mixed tumor of the soft palate develop from a "transplant" from the first surgical procedure?

Although mixed tumors have twice been removed from the soft palate, additional neoplasms may develop.

Bennie-Dillon Building.

MIDWINTER SEMINAR IN OPHTHALMOLOGY AND OTOLARYNGOLOGY.

The Eighth Annual University of Florida Midwinter Seminar in Ophthalmology and Otolaryngology will be held at the Sans Souci Hotel, Miami Beach, the week of January 18, 1954. The lectures on Ophthalmology will be presented on January 18, 19 and 20, and those on Otolaryngology on January 21, 22 and 23. A midweek feature will be the Midwinter Convention of the Florida Society of Ophthalmology and Otolaryngology Wednesday afternoon, January 20, to which all registrants are invited. The registrants and their wives may also attend the informal banquet at 8 p.m., on Wednesday. The Seminar schedule permits ample time for recreation.

The Seminar lecturers on Ophthalmology this year are: Dr. W. B. Anderson, Durham, N. C.; Dr. W. P. Beetham, Boston; Dr. W. C. Owens, Baltimore; Dr. A. B. Reese and Dr. M. C. Wheeler, both of New York City. Those lecturing on Otolaryngology are: Dr. E. N. Broyles, Baltimore; Dr. H. P. House, Los Angeles; Dr. W. J. McNally, Montreal, Canada; Dr. Dorothy Wolff, and Dr. D. Woodman, New York City.

TUBERCULOSIS OF THE LARYNX AND ITS TREATMENT WITH STREPTOMYCIN AND HYDRAZINE DERIVATIVES OF ISONICOTINIC ACID.

RICHARD R. LEHMANN, M. D.,
Otisville, N. Y.

Tuberculous of the larynx is a secondary disease. Primary tuberculosis of the larynx probably does not occur (Myerson[1]). The pathways of infection of the mucous membrane of bronchi, trachea, and larynx are:

1. bronchogenic
2. hematogenic
3. lymphogenic

Baccanini[2] believes that impaired balance of the autonomic nervous system is most frequently responsible for the spread of tuberculous infection to the upper respiratory tract; however, according to Dworetzky and Risch[3] in 80 per cent of all cases, the infection reaches the larynx by the bronchogenic route. The mucous membranes, being constantly bathed in sputum which contains masses of acid-fast bacilli, are continuously exposed to infection. While the bronchogenic infection of the larynx develops as an insidious, gradually increasing lesion, the hematogenic and lymphogenic infections occur with an acute onset, often involving the true and false vocal cords and the cartilages of the larynx.

The picture of the gross pathology of the larynx changes from a slight congestion of one vocal cord to an involvement of the whole larynx, although such severe cases as were formerly seen today occur but rarely. A slight congestion of one vocal cord, or a congestion of both cords, while one cord is more affected than the other might in a case of pulmonary tuberculosis be characteristic of a specific laryngitis. The

*From the Otolaryngological Service of Dr. Risch Municipal Sanatorium, Otisville, N. Y., New York City Department of Hospitals.
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state of inflamation of the vocal cords then changes to the state of subepithelial infiiltration. The cords are more or less swollen and frequently one can visualize small nodes, granulations on the cords, and small ulcers with a predilection of the posterior third of the cords. Particularly the edges of the cords are involved and show a notched appearance. Larger ulcers appear on the surface of the cords and an infiltration of the false vocal cord often completely covers the true cords, limiting or preventing their movements. Frequently the arytenoid region and the epiglottis are involved. There is an infiltration of the arytenoid region with edema and the typical ashen-grey color of the mucous membrane. The epiglottis in this case presents a characteristic turban-shaped appearance; infiltrations become necrotic, superficial and deeper ulcerations occur and at the posterior commissure, infiltrations are frequently found which are usually quite persistent and resemble a genuine pachydermia of the larynx, the histological structure of which is that of a papilloma. Sometimes an isolated tuberculosis of the epiglottis also is seen.

Thirty to forty years ago, we saw many severe cases of tuberculosis of the larynx which were a heavy burden to the specialist. They were usually associated with far advanced pulmonary tuberculosis, and the prognosis was very poor. Formerly treatment consisted of lactic acid, silver nitrate, Finsen radiation, and in appropriate cases, cautery. In the early forties we used vitamins, promin, chaulmoogra oil, and cautery. Today only streptomycin and recently the hydrazine derivates of isonicotinic acid (rimifon and marsalid), are considered as the treatment of choice.

Several decades ago tuberculosis of the larynx occurred far more often. Today fulminant cases are almost exceptions, and the majority of cases of pulmonary tuberculosis, complicated by laryngeal tuberculosis, are less severe. Over the years, the incidence of tuberculosis of the larynx decreased, and today the percentage is very low. Dworetzky and Risch[3] published statistical observations on frequency of tuberculosis of the larynx in a population of 500 patients with

pulmonary tuberculosis at the Municipal Sanatorium, Otisville, N. Y. The following figures illustrate the decline of incidence of this complication over the years:

	Pulm. Tbc.	Lar. Tbc.	Per cent
1914	500 cases	128 cases	25.6
1934	500 cases	73 cases	14.6
1941	500 cases	18 cases	3.6

The most important reasons for this remarkable reduction in the occurrence of tuberculosis of the larynx are according to Dworetzky and Risch:[3]

1. The ever-increasing educational campaigns which are leading to more efficient case findings. Mass X-ray pictures play an important role in improved diagnosis both as to the number of cases discovered and their early recognition.

2. The follow-up of all contact cases by the Board of Health.

3. The tremendous advances in treatment by collapse therapy and surgery.

All these reasons are far more valid today than they were in 1941, when these authors published their observations. Since 1941 streptomycin, PAS, and recently the isonicotinic hydrazides have further improved the therapeutic results in pulmonary tuberculosis. With modern technical improvements treatments like phrenic crush, Jacobeus operation, thoracoplasty, are today frequently replaced by lobectomy, pneumectomy, and pneumoperitoneum. Sputum concentrates and gastric cultures of the majority of patients become negative under adequate treatment, and the danger of infection of the larynx is, therefore, reduced to a minimum.

It is a statistical fact that most cases of laryngeal tuberculosis occur in advanced and far advanced cases of pulmonary tuberculosis. The incidence of laryngeal tuberculosis in post mortem examinations is usually higher than observed clinically (Auerbach 1945[4]). Meyerson[1] examined the larynx of a number of patients a few days before death and was

astonished at the great difference between the pre-mortem and post-mortem appearance. He explains this fact with a hematogenous spread of the disease just before death.

The statistics of Thomson[5] in 1924 and the Moscow District Institute for Tuberculosis[6] in 1945, provide further evidence. Thomson found the proportions of laryngeal complications in early lesions to be 4.2 per cent, in more severe cases 18. per cent, and in far advanced cases 31 per cent. The Moscow District Institute for Tuberculosis showed that 5.5 per cent belonged to the group with minimal lesions, 24 per cent to the group of moderately advanced, and 64 per cent to the group with far advanced lesions.

Treatment of laryngeal and tracheo-bronchial tuberculosis is supplemented by antibiotics and in the last year by the isonicotinic hydrazides. The first two reports of the dramatic effect of streptomycin on laryngeal tuberculosis were published by Figl and Feldman[7] and Hinshaw[8] of the Mayo Clinic. Other publications followed soon, all confirming the dramatic results of streptomycin in cases of laryngeal and tracheobronchial tuberculosis.

In a publication reviewing the therapeutic effects of streptomycin, Emil Bogen[9] makes the following statement: "Streptomycin exerts a definite beneficial effect in cases of tuberculous lesions in the mucous membranes of the mouth, larynx, trachea, and larger bronchi." The book "Streptomycin and dihydrostreptomycin in tuberculosis"[9] contains the reports by a number of authors of their observations in cases of tuberculous lesions of bronchi, trachea, larynx, and pharynx. They express their unanimous opinion that streptomycin produces healing of such lesions within a surprisingly short time without any recurrence. Evidence of healing of such lesions appears within the first week of therapy, and in many cases the process of healing is mostly completed by the end of the second month; however, not always are we successful, frequently it depends on the progress or regression of the pulmonary tuberculosis.

As to the dose, the total amount, and the form of application of streptomycin, it is a well-known fact that at first this antibiotic was applied in too large doses. The most annoying toxic side effects were disorders of the vestibular and, less frequently, of the cochlear organ.

Vertigo, ataxia, diminished or even absent response to caloric stimulation of the labyrinth, evident in the degree of physiological nystagmus, were frequent side effects of large cumulative doses of streptomycin. Other toxic effects were diminished renal function, fever, and blood dyscrasias.

In 1948 the Veterans' Administration[10] published a report on 112 cases of tracheo-bronchial and 166 cases of laryngeal tuberculosis among a total of 2780 patients with pulmonary tuberculosis. These patients were treated from 1946 to 1948. Streptomycin was given in doses of 1.8 gm. and 1 gm. twice daily for 120 days, the total of one course being 216 and 120 gms. respectively. When maximum improvement was reached earlier, the treatment with streptomycin was discontinued. Although the underlying pulmonary pathology was frequently of a type which streptomycin could not influence significantly, prompt and excellent results of this treatment were observed and 80 to 90 per cent of the tracheo-bronchial and laryngeal lesions healed or improved. It was found that the results with 1 gm. streptomycin in two daily injections are superior to those obtained with 1.8 gm. a day in five injections. A recurrence of symptoms was observed in 8 to 13 per cent. These patients responded well to a new course of streptomycin.

One has to remember that a resistance of the tubercle bacillus to streptomycin develops frequently. One should be reluctant to use streptomycin for minimal pulmonary tuberculosis when other methods of treatment may have the same effect in order to save this valuable anti-biotic for a case of greater need.

Streptomycin as aerosol does not affect laryngeal tubercu-

losis according to the experience of Myles Black et al.,[11] A. Lyman et al.,[12] Etienne Bernhard,[13] and Jules Hall.[14] Only intramuscular injections are effective.

In Sanatorium Otisville streptomycin is administered intramuscularly in doses of 1 gm. every third day. It is given in one or two injections a day, the total amount of one course is 42 gms. One course is usually not sufficient, and we continue the treatment with the antibiotic often for 12 to 16 months always combined with PAS. Of course, in cases with fever and pneumonic infiltrations we apply 1 gm. daily for one to two weeks until the temperature is normal, and continue then with 1 gm. every third day. With this mode of treatment we very rarely observe disorders of the labyrinth or other toxic manifestations. Observations of other authors and our own experience indicate that the improvement often continues following discontinuation of streptomycin therapy and may lead to final recovery.

Recently we read the reports about the effects of hydrazine derivates of isonicotinic acid on pulmonary tuberculosis by Robitzek, Selikoff, and Ornstein.[15] I will not mention all the details since they are covered by other workers in the field; however, besides some dramatic results in pulmonary tuberculosis the authors saw similar effects on extrapulmonary tuberculosis, for instance in cases of laryngeal tuberculosis. Our own observations with isonicotinic hydrazides and streptomycin in cases of laryngeal tuberculosis will be reported.

Other articles confirmed the first reports.

W. Steenken and Wolinsky[16] investigated the antituberculous activity of these drugs in vitro and in experimental infections of guinea pigs and rabbits. They came to the conclusion that these drugs have tuberculostatic and tuberculocidal action in vitro and produce a dramatic beneficial effect in vivo in the experimental animal. The same favorable effects on the experimental animal are reported by Bernstein et al.[17] On the other hand, the Committee on

Therapy of the American Trudeau Society[18] cautions: "It is already known that acid-fast bacilli resistant to these new drugs appear rapidly both in vitro and in patients."

Our treatment of choice in Sanatorium Otisville consists in the use of streptomycin in combination with rimifon. The use of both drugs produces a synergistic effect and delays the early resistance to isonicotinic hydrazides.

Up to December 1, 1952 we have treated in Otisville at least 100 patients with pulmonary tuberculosis with rimifon alone or combined with collapse therapy and streptomycin. We are starting now with 6 mg. per kg. for five days, continue with 7 mg. per kg. for the next five days, and then give 8 mg. per kg. until the drug is discontinued. Among these 100 or more patients with pulmonary tuberculosis were three patients with laryngeal tuberculosis. Our observations concern only these cases.

The following side effects of hydrazine derivates of isonicotinic acid have been reported:

Hyperreflexia, constipation, postural hypotension, dizziness, headache, drowsiness, twitching of extremities, numbness in limbs, delayed stream, eosinophilia, casts, albumin, reducing substances in urine, dryness of the mouth, and dyspnea.

We observed only rarely these side effects, except insomnia and numbness in limbs. Serious toxic reaction may occur in intractable asthma and in persistent hypotension. The susceptibility to ephedrine and epinephrine is increased. It is obvious, as Robitzek et al.[15] mention, that all these side effects are due to some disorders of the autonomic nervous system.

At the beginning of 1951 we had 388 patients in Sanatorium Otisville. Our new admissions amounted to 394 during the year, giving a total of 782 patients. Among these 782 patients with minimal, moderately advanced and far advanced pulmonary tuberculosis, only eight showed a laryngeal involvement, i. e. 0.98 per cent.

Dworetzky and Risch[3] reported in Otisville in 1941 only 440 patients with pulmonary tuberculosis, among them seven cases of laryngeal tuberculosis. The other 60 patients with pulmonary tuberculosis were seen by the authors in their private practice. These were, as the authors explained, more advanced cases and referred patients. This fact accounts for the higher occurrence of laryngeal tuberculosis in 10 cases, i.e. 18 per cent. So the percentage of laryngeal involvement in pulmonary tuberculosis in Sanatorium Otisville in 1941 was 1.6 per cent and in 1951 only 0.98 per cent. In 1952 we had 465 admissions, four of which were complicated by laryngeal tuberculosis, i.e. 0.86 per cent.

Our observations confirm the observations of other authors that laryngeal tuberculosis occurs far more frequently among male than female patients. Of our 12 patients with laryngeal tuberculosis ten were male and only two female.

A short summary of the laryngological findings in these 12 cases follows:

The first eight were seen in 1951, the following four in 1952.

Case 1: 32-year-old white male, complaining of hoarseness and pains in swallowing. Far advanced pulmonary tuberculosis, sputum positive.

Larynx: Vocal cords congested, swollen, margins irregular; small granulomatous area below interarytenoid region, false cords moderately edematous. Vocal cords fixed in adduction.

Case 2: 32-year-old colored male with far advanced pulmonary tuberculosis. Sputum positive, complains of pains in swallowing and hoarseness.

Larynx: Congestion and edema of true vocal cords, ulceration of the right vocal cord, considerable swelling of false vocal cords.

Case 3: 31-year-old white male with moderately advanced pulmonary tuberculosis. Sputum positive, complains of hoarseness.

Larynx: Left vocal cord oval shaped, shallow ulceration on the cord covered by a dirty whitish crust. Vocal cords congested.

Case 4: 50-year-old colored male with moderately advanced pulmonary tuberculosis. Sputum negative, complains of pains in swallowing.

Larynx: Pale granulated appearance of epiglottis, rest of larynx normal. A specimen was taken, the histological findings of which proved tuberculosis.

Case 5: 48-year-old colored male with advanced pulmonary tuberculosis. Sputum alternatively positive and negative, complains of hoarseness.

Larynx: Left vocal cord fixed in adduction, large granuloma of right false cord.

Case 6: 27-year-old white male with advanced pulmonary tuberculosis. Sputum positive, complains of hoarseness.

Larynx: (Report from Bellevue Hospital six months previously). Vocal cords congested thick and rough. Transferred with diagnosis. Moderately advanced pulmonary tuberculosis, laryngeal tuberculosis. When patient was seen in Otisville, his larynx appeared completely normal.

Case 7: 58-year-old white male with far advanced pulmonary tuberculosis. Sputum positive. He was treated for laryngeal tuberculosis in King's County Hospital six months previous to his admission to Otisville. His pains were so severe that he could swallow neither solid food nor fluids, and his hoarseness was so serious that he could communicate only by writing. Under treatment with streptomycin in K. C. H. pains ceased and voice improved.

Larynx: Infiltration of the left false vocal cord, covering the whole true vocal cord. The left arytenoid region is slightly thickened. The rest of the larynx is without pathological changes.

Case 8: 29-year-old white female with advanced pulmonary tuberculosis. Sputum positive. This patient started her laryngeal tuberculosis with an acute onset of fever rising within a few days to 102 degrees, with hoarseness, and pains in swallowing, radiating to the ears.

Larynx: On the second day of onset only congested vocal cords as in acute laryngitis. Three days later, the vocal cords congested and edematous, and there was an edematous swelling on both sides of the arytenoid region of the size of a small hazel nut.

The following four cases of pulmonary tuberculosis complicated by laryngeal tuberculosis were observed in 1952.

Case 9: 52-year-old white male with far advanced pulmonary tuberculosis. Sputum positive. Sick since 1931, hoarse since April 1949. Admitted to City Hospital on 11/29/50 for treatment of his hoarseness. He received for 13 months streptomycin aerosol treatment daily, but never intramuscular injections of streptomycin. According to the patient there was no improvement of his hoarseness during all this time.

Larynx: Congestion and swelling of both vocal cords, papillomatous pachydermic infiltration of posterior commissure.

Diagnosis: Pulmonary tuberculosis III, laryngeal tuberculosis, 6/27/52, transferred to Bellevue Hosp. for treatment of subluxation of cervical spine.

Case 10: 30-year-old colored female with far advanced pulmonary tuberculosis. Sputum positive, turned negative on 9/30/52. Admitted on 5/8/52 with increased temperature and hoarseness for five weeks.

Larynx: Severe congestion of vocal cords, left vocal cord edematous.

Diagnosis: Pulmonary tuberculosis III, laryngeal tuberculosis.

Case 11: 33-year-old colored male with moderately advanced pulmonary tuberculosis. Sputum positive. Admitted on 10/23/52. Hoarseness

and pains at swallowing for three months, pains in tongue on chewing for two weeks. Had previously received in another Hospital streptomycin and PAS without any improvement.

Larynx: Slight infiltration of epiglottis, superficial ulceration at the laryngeal surface of epiglottis, congestion and swelling of vocal cords.

Tongue: Small superficial ulcerations on both sides of tongue from back to front and a larger ulceration at the dorsum of the tip.

Diagnosis: Pulmonary tuberculosis II, laryngeal tuberculosis, tuberculosis glossitis.

Case 12: 52-year-old white male with far advanced pulmonary tuberculosis. Sputum was positive, sputum and gastric cultures are negative since early December, 1951. Hoarse since March, 1951. Received streptomycin for 14 months. On 12/20/51 right upper lobe lobectomy in Bellevue Hospital.

Larynx: 5/2/52. Congestion and nodular infiltrative swelling of right vocal cord. Left vocal cord congested is fixed in adduction. Slight infiltration of posterior commissure.

Diagnosis: Pulmonary tuberculosis II, laryngeal tuberculosis.

Seven of these 12 patients with laryngeal tuberculosis had far advanced, five of them moderately advanced pulmonary lesions. This fact confirms the statistics of Thomson[5] and the Moscow District Institute for Tuberculosis,[6] which showed that laryngeal tuberculosis occurs mostly in cases of moderately or far advanced pulmonary tuberculosis.

The first ten cases were treated with streptomycin and PAS. All these patients responded to streptomycin treatment with complete recovery or marked improvement. The first effect of streptomycin was the relief of pain after a few days. In Case 8, with the acute onset, the pain ceased within 24 hours after the first injection of streptomycin. The fever subsided after three days, the voice improved, the swelling of the vocal cords and the infiltration of the arytenoid region diminished considerably. After two weeks all pathological changes had almost disappeared. The infection was obviously hematogenous, and the unusually rapid action of streptomycin in this case was probably due to the fact that the treatment with the antibiotic was started in the earliest stage of infection. This patient also had an atelectasis of the left lung with complete obstruction of the left main bronchus. Today the endobronchial disease is healed as proven by a recent

bronchoscopy, and the larynx looks completely normal. Sputum and gastric cultures are negative, patient works in the Occupation Therapy Department two hours daily.

Even in cases of complete arrest and healing residua of the laryngeal infections sometimes persist. For instance, Cases 1 and 5 were completely arrested. In Case 1 both vocal cords are fixed in adduction, producing dyspnea at exertion, in Case 5 the left cord is fixed in adduction, as also in Case 12. Probably the arytenoid cartilages and the cricoarytenoid joints were involved and an ankylosis of the joint fixed the processus vocalis. In two other cases only a slight redness of the vocal cords remained, Cases 4, 6 and 8 healed completely. Case 7 at the time of his discharge showed an infiltration of the left false vocal cord and a swollen left true vocal cord; however, in regard to his general condition and the severity of his pulmonary and laryngeal tuberculosis, the effect of streptomycin was very good.

Case 9 tends to confirm the above mentioned observation of other workers that streptomycin as aerosol is ineffective. While the treatment with aerosol streptomycin for 13 months in another hospital did not improve his laryngeal tuberculosis the pachydermic infiltration of the posterior commissure was reduced to a considerable degree when streptomycin was administered intramuscularly.

Cases 11 and 12 and Case 2 were treated with rimifon in Otisville since previous treatment here or in another hospital with streptomycin had failed to produce satisfactory improvement of the larynx. In Case 11 it had not prevented a laryngeal or even a lingual involvement. The effect of rimifon in this case was at first excellent. Larynx and tongue were healed within two weeks. Unfortunately the patient was recommended by the Conference of bronchoscopy. It was postponed, but after complete recovery it was performed. A few days after bronchoscopy the patient had a relapse of the glossitis; however, he responded well to the continuation of his treatment with rimifon orally and locally in combination with streptomycin, but it changes from better to worse and today

six weeks after the bronchoscopy there are still some superficial ulcerations at the tip and edge of the tongue.

A similar case of tuberculous glossitis with involvement of the whole dorsum of the tongue is reported by E. Mamlock et al.[19] Complete healing was achieved with isonicotinic hydrazides within five weeks, while streptomycin with PAS has failed to halt the progression of the disease.

Case 12 was treated with rimifon since May 20, 1952, but the findings of his larynx did not change until the end of December, 1952.

Rimifon was also ineffective in Case 2 with a slight relapse. Findings on January 2, 1953, still showed a slight ulceration at the edge of the posterior third of the right vocal cord and a nodular granulation at the surface of the entire left vocal cord, although the patient has received rimifon for five months; however this is a far advanced case, and the sputum is persistently positive.

Concerning the therapeutic value of the hydrazides of isonicotinic acid in laryngeal tuberculosis, the treatment of choice in such cases should be first streptomycin. Good therapeutic results are backed by long and extensive experience in laryngeal and tracheo-bronchial tuberculosis, and only when the patient proves to be resistant to streptomycin, would rimifon alone be indicated. Perhaps the best method of treatment is the application of rimifon together with streptomycin.

We have in the isonicotinic hydrazides another drug which can be very effective in laryngeal tuberculosis where streptomycin fails to bring about improvement.

This report is presented as a follow-up study supplementing Dworetzky's and Risch's statistical survey of the incidence of laryngeal tuberculosis at Sanatorium Otisville in 1914, 1934, and 1941. It also confirms the observations of many other workers of the excellent therapeutic effect of streptomycin on tuberculous lesions of the larynx, pharynx, trachea,

and bronchi. Our own experience with the hydrazine derivates of isonicotinic acid (rimifon) in three cases of laryngeal tuberculosis and in one case of tuberculous glossitis is reported.

SUMMARY.

Laryngeal tuberculosis is a secondary disease of bronchogenic, lymphogenic, or hematogenic origin.

The gross pathology of laryngeal tuberculosis is described, and the different methods of treatment are reviewed. Cautery in suitable cases was the treatment of choice until the report from the Mayo Clinic in 1946 established the superior therapeutic action of streptomycin on laryngeal tuberculosis. Our own observations about the effect of isonicotinic hydrazides are reported.

Brief summaries of the laryngeal findings in 12 cases of laryngeal tuberculosis in 1951 and 1952 are given with the results of streptomycin and rimifon therapy. Statistical factors and possible causes for the decreased incidence of laryngeal tuberculosis in recent years are discussed.

I express my thanks to Dr. Bobrowitz, Medical Superintendent of Otisville Sanatorium, for the kind permission to use the hospital records for this article.

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SPEECH AUDIOMETRY TESTING FOR PRE-SCHOOL CHILDREN.

ADAM J. SORTINI, M.A.,
and
CARLYLE G. FLAKE, M.D.,
Boston, Mass.

The great majority of preschool children referred to an otologist or a hearing clinic for a suspected hearing difficulty, have speech but are unable to cooperate sufficiently to insure a reliable pure-tone audiometric test. Even after a pure-tone test has been obtained with children in this age group, the tester frequently may be in doubt as to the validity of the results. Because of the time usually required to give instructions and administer a pure-tone test, the attention span of the preschool child usually wanes rapidly and it becomes quite difficult for him to concentrate on pure tones, particularly when his threshold at different frequencies is approached. Ewing and Ewing[1] have stated that with children under five years of age, pure-tone audiometry is not advisable, because of the child's inability to maintain interest in listening to pure tones for any length of time, resulting in unreliable threshold readings. Although Wishart[2] states that "speech reception thresholds have no value whatever in the testing of children's hearing," many authorities disagree. Dickson and Chadwick[3] feel that in analyzing auditory function, the ability to hear and understand speech is the most important quality to be determined. Hardy and Pauls[4] report that speech hearing tests reflect the level at which the child lives with his impairment, and that for the purposes of determining the nature and extent of a hearing loss, as well as future therapy, speech tests are more valuable than pure-tone audiometric tests.

Several studies have been conducted which have established a high correlation between speech testing and pure-tone testing. Hughson and Thompson[5] found the relation between

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a pure-tone audiometer loss and a speech reception loss to be definite and specific. Harris[6] found that speech testing and pure-tone audiometry (through the speech range of 500-2,000 cps.) were closely related and measured almost the same auditory function. He regards the relationship between the two tests as a straight line function.

It is evident, therefore, that: (*1*) A reliable pure-tone audiometric test is difficult and in some cases impossible to obtain with preschool children, (*2*) a speech reception threshold is at least as important to obtain as a pure-tone audiometric test and (*3*) there is a high correlation between the ability to hear pure tones and the ability to hear and understand speech.

There are several different items to be considered in the administration of the test to be described: (*1*) Noise level in the testing room, (*2*) type of equipment used and (*3*) technique used in test administration.

In reference to the noise level, although it is more desirable to conduct the testing in a sound-proofed or sound-treated room, a quiet room is sufficient for diagnostic purposes.

The equipment used at the Children's Medical Center* consists of a console Speech Audiometer, Model 1160, containing the following equipment which can be used either for speech or pure-tone testing: (1) A 16″ transcription turntable handling 10, 12, 16 inch records and transcriptions at speeds of 33.3 and 78 r.p.m. including a 16″ pickup arm with two diamond tipped cartridges for microgroove and standard recordings, (2) a Speech Audiometer constructed in accordance with the Proposed American standards for Speech Audiometers (Draft of May 1, 1951) with a sound pressure level of 135 db. at the earphones, and properly calibrated attenuators for threshold measurements. The attenuators normally show attenuation from 135 db. since a standard value for the normal threshold of speech should be determined for the characteristics of the test material used, the tester's voice and the electroacoustic characteristics of the speech audiometer and testing room empirically, (3) a white noise generator (constructed in accordance with standards referred to above), through which noise can be fed to either the ear being tested or the contralateral ear. Sound pressure level characteristics and attenuators are the same as those on the Speech Channel, (4) provision for speech and noise to be fed through the earphones or loudspeaker simultaneously if so desired, (5) a Western Electric 633-A microphone for live voice testing, used in conjunction with a large broadcast-type meter for monitoring, including a calibration control, (6) a James Lansing D-130 loudspeaker in matching cabinet, for free field testing up to a sound pressure level of

*Built by the Grason-Stadler Company, Cambridge, Massachusetts.

135 decibels (re .0002 dynes per square centimeter) when desired. (7) a two-way intercommunication set, the direction of operation determined at the console and (8) a Maico H-1 pure-tone audiometer whose output can be fed through the Speech Audiometer when so desired, enabling all tests to be conducted from a central position.

Close-up of Speech Audiometer Panel.

Speech Audiometer Console showing turntable and pure-tone audiometer.

Although a tester may conduct the entire test to be described unaided, it is helpful to have an assistant to put the child at ease. The parent may take over this function if the child is upset by the strange surroundings.

This type of test may be administered not only with a console speech audiometer but also with a semi-portable or portable model which is comparable in size and price to the clinical pure-tone audiometer used by otologists and clinics. Thus, although the console model may be more desirable for the average clinic, the semi-portable or portable type model would perhaps be more desirable for the otologist's office or the small clinic.

The technique used for testing the preschool child's ability to hear and understand speech at the Hearing Clinic of the Children's Medical Center is as follows: The child is brought into the testing room and told that he is to play a "game". He is then shown a tray containing several small toys of the type available at almost any five and ten cent store. Some of the "spondee" toys are "cowboy", "airplane", "baby", etc. Some of the toys may be used either as spondee or phonetically balanced test items (e.g. "airplane" may be used as "plane", etc. The child is allowed to handle the toys, then name them. The average child usually becomes immediately interested and his naming of the toys establishes: (*1*) sufficient speech for test cooperation and (*2*) *his* terminology for the test items used. (Although the average child calls the "baby" by its proper name, some children identify it as a "dolly", "girl" or "boy".) Thus the tester is able to call the item by the name the child associates with it.

The free field threshold is usually obtained first as experience has shown this approach results in better patient cooperation. It is easier to obtain and usually convinces the child that he *is* playing a game, thus putting him at ease and aiding in securing his full cooperation. The tester then tells the child he will be asked to pick up one of the toys and hold it up so that the tester in the next room, or his mother seated beside him, will be able to see which toy he has been asked to select. The child is seated three feet away from the loud-

speaker for free field testing since this is the distance at which normal thresholds have been established empirically for the equipment described in this paper. The child is told by the tester that he will talk to him through the "big box" in the corner and that the "game" will consist of holding up a specific toy for the tester. The child is then told that when he is not able to hear the instructions, he should inform the tester so that he will make his voice louder and the "game" may be continued. The tester then goes into the next room, after seating the mother or assistant beside the child. The test procedure begins by asking the child to "show me the airplane", "give mother the baby", "take the cowboy from mother", etc., using the attenuators on the speech audiometer until a speech reception threshold is obtained (i.e. 50 per cent of the test items are positively identified by the child consistently). After the free field threshold is recorded, earphones are used with the same technique to obtain speech reception threshold for each ear individually by air conduction, and then, if indicated, bone conduction speech reception thresholds may be obtained by using the microphone circuit on the pure-tone audiometer. An interesting item usually observed which aids in the reliability of the test is that the majority of children put the toy up to the earphone from which instructions are being given. This indicates to the tester the child's ability to localize the sound of the instructions properly. In some instances the child will either refuse to speak or be unable to do so, yet understand what is asked of him and will identify the toys correctly so that thresholds may then be obtained. In the event the child refuses to cooperate and is known to have speech, a retest is recommended; when satisfactory results are unobtainable by this method and the child is known to have no speech or to lack the ability to associate the name of the toy with the object itself, psycho-galvanic skin-resistance audiometry is employed. If an individual pure-tone audiometric test is not deemed wise or when results obtained from such a test are not considered valid, speech reception threshold testing is done routinely at this time in connection with skin-resistance audiometry.

With the described test, after the few minutes necessary for instructions, free field, air and bone conduction results are usually obtainable in an average time of ten to fifteen minutes. The child is usually fascinated by the toys and, the fact that he is not only able to *see* the test item but *feel* and *handle* it, assures the attention span being held for the whole "game." Full cooperation of the child is usually easy to obtain and maintain. It is possible by using this test to obtain diagnostic results with children where pure-tone audiometric testing would be out of the question. The youngest child tested to date at the Hearing Clinic of the Children's Medical Center using the described method was a 26-months-old boy. He was thought to have normal hearing but was referred as a matter of course after recovering from influenzal meningitis treated with streptomycin. Results obtained indicated one normal ear, but a moderate loss in the other ear so that, although the child's social adequacy for hearing was sufficient, he had some difficulty in localizing sound. In instances where older children or adults are being tested, the W-1 recorded lists, available from the Central Institute for the Deaf in St. Louis, Missouri, may be used for the purposes of obtaining speech reception thresholds when desired.

SUMMARY.

There are two items of importance to be considered in speech hearing testing: (*1*) *The Speech Reception Threshold,* by definition the level at which one is able to understand and repeat 50 per cent of what is said to him and (*2*) *Speech Sound Discrimination Ability,* which is one's ability to discriminate fine speech sound differences with noise level at a minimum. The test described in this paper is able to produce the former, and if desired, the latter by testing the child's speech sound discrimination ability with toys like "plane" and "train", "goat" and "boat", etc. Although the test is most helpful for evaluating the preschool child's ability to hear and understand speech, it may also be used as a diagnostic tool with older children and adults where doubt exists as to the validity of the results obtained through

pure-tone audiometry, and skin-resistance audiometry is not available. It should be noted, however, that with older children in the average school health program where the main concern is detection and prevention of deafness, an individual pure-tone audiometric test which checks the high tones as well as the speech range, is most desirable, when the child has failed the screening test.

Similar tests to the one described here are in use in only a few university clinics and hospitals throughout the country. Preschool children are usually tested by means other than those described here although the necessary equipment is often available and the administration of the test is much less time consuming than a pure-tone audiometric test.

The test may be used to advantage by the otologist who may determine the extent of a hearing loss and in many instances the nature of such a loss and requires a much shorter time than is possible by using pure-tone audiometry.

Thus, it would seem that the test described which: (*1*) requires short administration time, (*2*) insures a high degree of subject cooperation and (*3*) holds the child's attention for the whole testing period, is a reliable evaluation of the preschool child's ability to hear and understand speech from an active communication standpoint. This eliminates the need at this age level for the more time-consuming and less reliable pure-tone audiometric test.

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A HELMET-HELD BONE CONDUCTION VIBRATOR.

J. D. HARRIS, Ph.D.; H. L. HAINES, M.D., and
C. K. MYERS, B.S.,
New London, Conn.

INTRODUCTION.

It is a common clinical observation that an air conduction audiogram is of itself often an incomplete guide to the diagnosis of a hearing defect. A more complete analysis can be made if bone conduction data are at hand as a supplement; in fact, it has been contended[6] that bone conduction tests may give a more direct picture of cochlear function than air conduction tests.

The traditional instrument for determining bone conduction thresholds is, of course, the tuning fork; but an audiometric bone conduction vibrator may be thought of as an electronically-driven tuning fork, and possesses the advantages of producing a wide frequency range, and of constant intensity output. It has been further emphasized[7] that all classical fork tests can easily be done with a vibrator, often with improved accuracy.

A number of workers have reported their success in providing reliable bone conduction audiometry, either in terms of standard deviations within a normal-hearing group or in terms of testing the same individuals over a period of time. The National Health Survey[5] covered 1,242 normal ears, and Greenbaum, Kerridge and Ross,[2] 100 individuals, presenting standard deviations per frequency. Carhart and Hayes[1] reported mean test-retest differences for 250 patients with a wide range of hearing loss. Harris and Myers[3] reported the standard deviations of 10 consecutive thresholds. These four studies are summarized in Table 1. (It is clear that only the

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top two rows of figures have any possible correspondence, since very different statistics are used for the third row and the last three rows.)

Table 1 makes it clear that comparable reliability can be expected from bone as from air conduction audiometry, under proper conditions. Note, for example, in Table 1 that the S.D. of test-retest differences reported by Carhart and Hayes is at all frequencies *larger* by air than by bone conduction.

TABLE 1. ESTIMATED RELIABILITY OF BONE CONDUCTION AUDIOMETRY.

	64	128	256	512	1024	2048	4096	8192
Ref. 5			7.4	7.4	7.5	8.3	8.5	8.7
Ref. 2	6.9	7.9	6.5	7.4	8.2	6.8	7.1	7.0
Ref. 1 (bone)			7.7	8.3	7.6	9.0	9.4	
(air)			9.2	9.1	8.3	9.1	9.7	
Ref. 3, Subj. 1		.95	.63	.75	.63	1.45	1.33	.82
Subj. 2		1.14	1.2	.67	1.14	.75	1.00	.46
Subj. 3		1.14	1.58	1.04	1.20	1.20	1.14	.85

NOTE:
Ref. (5) = S.D. of 1,242 normal ears.
Ref. (2) = S.D. of 100 normal ears.
Ref. (1) = S.D. test-retest deviations of 250 patients (air conduction data added for comparison).
Ref. (3) = S.D. of 10 consecutive thresholds.

One source of dissatisfaction with vibrators is the manner in which they are coupled to the skull.

The bone conduction vibrators of several commercial audiometers are designed so that the patient holds the vibrator against his mastoid. This seems objectionable according to Lierle and Reger[4] for the following reasons:

1. Tremors or fatigue of the arm and hand of the individual holding the vibrator may affect response.
2. The position of the vibrator on the mastoid might be shifted, and
3. The thrust may be changed.

These authors designed a scissors-like holder to fit on the head and mounted an adjustable spring between the two upright arms, so that the position and the force of the vibrator against the mastoid could be maintained at a constant 410 gm. No data on test-retest reliability were included in their report, but they seemed enthusiastic over the possibilities of the vibrator-holder.

In lieu of plans for a holder such as Lierle and Reger used, we designed a holder on somewhat different principles. This paper reports our experiences with a Sonotone bone conduction vibrator in this holder.

APPARATUS.

It was desired to lead to the bone conduction vibrator two pure tones of the same frequency; first, a warning tone, and after one-half second of silence, the test tone proper. Build-up and decay times for the tones were all 0.04 seconds. The warning tone was 0.35 seconds in duration at the half-down point, the test tone was 0.75 seconds. A pure tone of the desired frequency was produced by a Hewlett-Packard Model 200 oscillator, and led to an amplifier and associated timer which controlled tone envelopes, durations and intervals. The output was split and led through either of two banks of attenuators, suitably isolated. (A switch allowed the experimenter to choose which channel, for the warning or the test tone, was used.) The channels were again united, led to a matching transformer, and thence to a Sonotone Type 21-308 bone conduction vibrator. The transformer had sufficient taps so that the impedance of the input could be matched to that of the vibrator at any test frequency used. Information on impedance versus frequency was kindly furnished by the manufacturer.

The vibrator was held in a universal joint and mounted (with a variety of adjustments possible) on a metal band fitting around the head, as in Fig. 1. The whole assembly, including the vibrator, weighs 822 gm. The band was thinly lined with felt and partially supported by a thin disc resting on top of the head. The two arms which supported the uni-

versal joint were connected to a coiled spring with a rack-and-pinion coupling on the spring housing. By this means the helmet could be adjusted to any head, the vibrator tip moved to make contact with the most prominent part of the mastoid

Fig. 1.

area (of either side) and with its axis looking directly toward the cochlea, so far as could be determined. The adjustment on the coiled spring housing determined the force applied by the vibrator tip to the mastoid. This force was measured in

grams with a calibrated manometer composed of two thin layers of plexiglass milled out and connected to a meniscus, the whole containing a small quantity of mercury. Forces of 100, 200 and 400 gm. were calibrated with especial care.

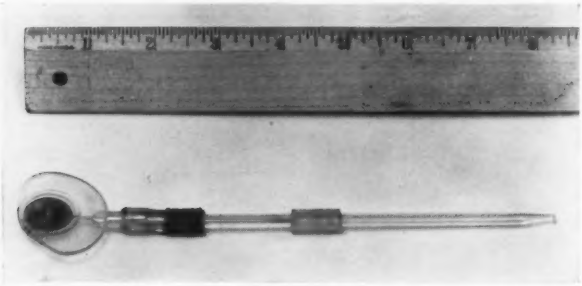

Fig. 2.

PROCEDURE.

Subject was comfortably seated, the helmet fitted, and the vibrator tip put at the correct place, angle and force. A frequency was selected and the warning tone adjusted to 15 db above threshold. The attenuator controlling the test tone was then handled systematically in 1 db steps to determine threshold by the method of limits, using two ascending and two descending series to define a mean threshold.[3]

RESULTS AND DISCUSSION

1. What is the instability of the bone conduction threshold?

A detailed study has been made[3] of the shifts of bone conduction threshold during a single experimental session. These shifts were of the order of 1 db or less. In Table 2, Condition 2, the same degree of stability is achieved, and we conclude that 1 db encompasses the inherent short-term instability of the threshold, *plus* the experimental error contributed by the psychophysical procedure. Instabilities larger than 1 db, then, we cannot explain by referring to changes in real threshold or to inaccuracies of testing method.

TABLE 2. RELIABILITY OF BONE CONDUCTION AUDIOMETRY BY THREE PROCEDURES.

	CONDITION			
	1	2	3	3-1
c.p.s.	Helmet Removed and Replaced	Helmet Not Moved	Vibrator Hand-Held	Advantage of Helmet
250	1.77 (1.33)	.77	2.58 (3.17)	.81 (1.84)
500	1.74	.88	2.63	.89
1,000	1.63 (1.08)	.99	1.97 (2.55)	.34 (1.47)
2,000	2.15	.88	2.76	.61
4,000	2.25	1.14	3.12	.87
8,000	1.87	1.11	3.18	1.31

ENTRY: Average difference between 10 test-retest thresholds for five experienced subjects. (Note: data in parentheses from 22 inexperienced subjects.)

2. What is the reliability of the usual hand-held procedure?

The test-retest reliability of the freely-held receiver is shown in Condition 3 of Table 2, ranging from 2 to 3 db. This compares favorably with air conduction audiometry. Carhart and Hayes[1] report a 7 to 9 db test-retest deviation, though it must be remembered that their data contain the effects of therapy between test and retest.

Our small deviation is partly attributable to the experience of our subjects, who knew where best to place the vibrator and what was approximately the optimum force for their own ears; however, with 22 totally inexperienced subjects, we obtained deviations of only about one-half db larger, and we conclude that bone conduction audiometry can reach satisfactory reliability.

3. What does the helmet contribute to reliability?

A quick look at the difference in reliability between the helmet-held and the hand-held procedure is given by comparing Conditions 1 and 3 in Table 2; the advantage of using the helmet is summarized in the last column. The helmet allows a test-retest to agree only about 1 to 2 db better than if the helmet is not used, the advantage being somewhat greater with inexperienced subjects.

To find whether, on separate occasions altogether, repeated audiograms are usally similar, we wish to know the standard deviation of repeated audiograms taken days and weeks apart. In Table 3, the variance of successive thresholds is reduced

TABLE 3. STANDARD DEVIATIONS OF 20 INDEPENDENT BC THRESHOLDS.

	S No. 1		S No. 2		S No. 3		S No. 4		S No. 5	
c.p.s.	Helmet	Hand	Helmet	Hand	Helmet	Hand	Helmet	Hand	Helmet	Hand
250	3.33	**3.59**	2.32	**3.29**	4.64	**5.48**	2.41	2.18	1.50	**2.60**
500	3.10	2.71	2.63	**4.28**	3.19	**5.93**	4.55	4.02	2.42	**3.60**
1,000	2.33	**2.65**	2.27	2.21	1.84	**2.00**	4.41	4.08	2.82	**3.88**
2,000	3.98	**6.40**	2.28	**3.29**	2.49	**4.26**	4.32	**4.91**	2.39	**3.87**
4,000	4.97	3.94	5.56	3.19	4.60	4.33	5.70	**7.95**	5.91	3.63
8,000	3.51	**4.53**	1.88	**4.21**	3.50	**3.61**	2.99	**4.64**	1.80	**3.08**

NOTE: Cases in **bold face** of helmet reducing variance of thresholds.

in 21 of 30 cases by the helmet, the largest reduction being 2.74 db. We conclude that the advantage of the helmet is real but is of the order of a very few decibels. For careful work, we agree with Lierle and Reger that "a headband which would insure the vibrator to be held against the mastoid (or other bones of the head) with the same pressure from patient to patient also seems a highly desirable accessory."[4] (p. 221)

It might be expected that the threshold might vary with the force applied to the mastoid. Table 4 compares thresholds for three degrees of force. No effect of force is seen at 1,000 and 8,000 c.p.s., but evidently a better contact between the vibrator and the skull makes a good deal of difference at 250 c.p.s., where 11 db less voltage need be applied at 400 gm. as against 100 gm. to reach the same threshold. Certainly for the lower frequencies it would seem advisable to standardize the applied force at some level.

Table 5 shows that a force of only 100 gm. introduces additional variability, but that it is immaterial whether the force is 200 or 400 gm. We conclude that the force with which the vibrator should be applied to the mastoid should be standard-

TABLE 4. EFFECT OF APPLIED FORCE ON ABSOLUTE THRESHOLD.

	GRAMS FORCE		
c.p.s.	100	200	400
250	16.8	22.2	27.8
1,000	18.3	17.5	17.0
8,000	17.2	17.8	19.4

ENTRY: Dial readings at threshold, in decibels below one volt. Mean of three subjects, 10 thresholds each, for all nine conditions.
CONCLUSION: Thrust affects threshold at 250 c.p.s. only.

ized by some mechanical device and maintained between 200 to 400 gm. (we have found subjects objecting to the discomfort at higher values).

TABLE 5. EFFECT OF APPLIED FORCE ON TEST-RETEST VARIABILITY.

	GRAMS FORCE		
c.p.s.	100	200	400
250	3.5	1.7	1.7
1,000	3.1	1.5	1.7
8,000	2.2	2.2	1.9

ENTRY: Mean test-retest variability, in decibels. Mean of three subjects, 10 test-retest comparisons each, for all nine conditions.
CONCLUSION: Thrust immaterial between 200 to 400 gm.

4. General considerations.

It will be recalled that the reliability of the usual hand-held procedure was, even with inexperienced subjects, of the order of 3 db. Why, then, do we hear so frequently that bone conduction audiometry is so unreliable as to make it not worth the while? It would seem that the equipment itself is not a major source of unreliability. We have seen in this paper that standardizing the coupling of the vibrator to the skull can contribute something to reliability, but that inequalities of coupling cannot account for the unreliabilities often complained of. The trouble, then, must lie in the procedure. Without much question, the chief offender is improper masking.

We have observed that very few clinics utilize the necessary 2,000 cc. cavity over the ear to be masked; and of course the most efficient masking noise band width is not standardized, nor the optimum intensity levels to use for various hearing losses and binaural acuity differences; nevertheless, the success of Lierle and Reger in assessing bone conduction acuity should be duplicative in less well ordered clinics, and the present writers believe that future efforts to standardize bone conduction audiometry should examine the question of masking with particular care.

SUMMARY AND CONCLUSIONS.

A Sonotone Model 21-308 bone conduction vibrator was mounted in a helmet, making it possible to adjust and standardize the position of the vibrator tip on the mastoid process of either side, the angle of thrust, and the applied force. It was hoped by this means to improve the interpretability of bone conduction audiometry, an extremely valuable clinical tool where it can be trusted.

Test-retest thresholds with the helmet and with the hand-held vibrator were collected on experienced and inexperienced subjects, at six octaves from 256 through 8,192 cycles per second. Ten repetitions were performed for each experienced subject, deliberately extended over several weeks or months. The difference between successive thresholds was somewhat less with the helmet than without; furthermore, the helmet significantly reduced variance among thresholds repeated over extended periods. Evidently, the increased precision of a single threshold (the usual clinical situation) makes worthwhile some such standardization as used here.

It was recommended that applied force be standardized anywhere between 200 to 400 grams.

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AN EVALUATION OF CARAMIPHEN ETHANE DISULFONATE AS AN ANTITUSSIVE AGENT.

G. GORDON SNYDER, M. D.,*
Bryn Mawr, Pa.

Recently we evaluated clinically the antitussive properties of a new anti-cholinergic compound, caramiphen ethane disulfonate. This new compound, which is bis-[1-(carbo-β-diethylaminoethoxy)-1-phenylcyclopentane]-ethane disulfonate has been available as an antitussive agent in Europe since 1950. Chemically, it is closely related to Panparnit, a compound that is used effectively in Parkinson's disease.

There have been few reports on the use of caramiphen ethane disulfonate, since the compound was but recently made available for investigation in this country. Liechti[1] described its use in a series of 112 patients, from seven months to 86 years old, 100 of whom obtained satisfactory relief from cough. Liechti also emphasized the fact that the compound proved free of the side-effects, as well as of the tendency to over-depress the cough reflex that at times accompany the use of some antitussive agents. In this country, Segal[2] has described his experiences with the compound; he found it to be free of atropine-like effects, to be well tolerated, and to appear to exert a sedative effect on the bronchioles in treating the bronchitic cough that accompanies asthma. Recently, Hudson,[3] in a letter to Lancet, mentioned the usefulness of the compound in controlling the non-productive cough associated with bronchial carcinoma, or tracheobronchial tuberculosis, and the spasm of coughing associated with severe chronic bronchitis.

The antitussive property of the compound was compared[4] pharmacologically, in 17 cats, to that of codeine phosphate by

*Assistant Attending Otolaryngologist, Bryn Mawr Hospital, Bryn Mawr, Pa.

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measuring the dose required to suppress cough that had been induced by electrical stimulation of the laryngeal nerve. On the basis of intensity and duration of action, caramiphen ethane disulfonate in doses of 5 mgm./kgm. approximated the action of codeine phosphate in doses of 1 mgm./kgm. Whereas codeine phosphate markedly depressed respiration, the new compound had little effect. In addition, it exhibited only one-fifth the pressor action of codeine. The acute toxicity studies showed that rats that received as much as 1200 mgm./kgm. of the compound showed no ill effects. In studies of subacute and chronic toxicity, doses of up to 100 mgm./kgm. for from one to three months produced neither gross pharmacologic effects nor histopathologic changes in the tissue of rats and dogs.

MATERIAL AND METHOD.

To reach a clinical impression of the worth of caramiphen ethane disulfonate,* we supplied it, in the form of syrup or tablets, to 100 patients seen in private practice. No attempt was made to select these patients on the basis of age, nor, indeed, on the type, or the etiology of their coughs. Twenty-four of them were from five to 15 years old; eight were over 60. As may be seen in Table 1, the coughs accompanied or followed eight different conditions, with the greatest number accompanying acute tracheitis and chronic ethmoiditis. As one would expect, the coughs could be classified—but only roughly, because of frequent overlapping—as either dry or moist. Thus, 48 patients had dry, hacking, paroxysmal coughs, which had persisted, in 12 of these patients, for more than three weeks. The other 52 patients had spasmodic, moist, but usually unproductive coughs, which had persisted, in 10 of these, for more than three weeks.

There was little on which to base a choice between the tablet and the syrup forms of the preparation, except perhaps the convenience of the tablet, which seemed especially suited to school children, and of course the demulcent effect of the syrup, which seemed especially suited to those with sore, inflamed throats. Thus, 37 adults took the tablet; 39 took

*Toryn (trademark of Smith, Kline and French Laboratories) was the caramiphen disulfonate preparation used.

TABLE I

Condition Associated with Cough	Total Number of Cases	Number with Dry Cough	Effectiveness in Dry Cough				Number with Moist Cough	Effectiveness in Moist Cough				Over-All Effectiveness			
			Excellent	Fair	Poor	Nausea		Excellent	Fair	Poor	Nausea	Excellent	Fair	Poor	Number Who Stopped Because of Nausea
Post-tonsillectomy	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0
Tracheitis.....	21	15	13	0	1	1	6	5	1	0	0	18	1	1	1
Sinusitis.....	44	21	13	5	3	0	23	17	2	1	3	30	7	4	3
Bronchitis.....	15	2	2	0	0	0	13	11	1	0	1	13	1	0	1
Laryngitis.....	4	2	1	0	0	1	2	2	0	0	0	3	0	0	1
Atrophic Rhinitis.....	2	2	1	1	0	0	0	0	0	0	0	1	1	0	0
Rhinitis.....	8	1	1	0	0	0	7	6	0	1	0	7	0	1	0
Naso-pharyngitis....	5	4	3	1	0	0	1	1	0	0	0	4	1	0	0
TOTALS....	100	48	34	8	4	2	52	42	4	2	4	76	12	6	6

the syrup. Ten of the children took the tablet; 14 took the syrup. Each tablet, as well as each teaspoon of the syrup, contained 10 mgm. of the caramiphen salt. Those who were over 15 years of age were told to take one teaspoon (or one tablet) every four or six hours during the day, as well as when needed, as long as they did not exceed five doses a day. The parents of the children were told to administer one dose three times a day, or one-half the dose, in the case of the younger children.

The patients were seen one or two weeks after the supply of the syrup or tablets had been given them. At that time, they (or their parents) were asked their opinion of the medication. Primarily, of course, we were interested in learning if the medication had reduced the patients' coughing or had loosened the cough, and if it had thereby reduced the interruption of sleep or other annoyances that accompany coughs. Secondarily, however, we were interested in discovering if the medication had exerted the undesirable effects, such as constipation or drowsiness, sometimes associated with the use of narcotic antitussive agents. Moreover, we wanted to know if the medication might depress the cough reflex to a point where it might concern the physician.

RESULTS.

Table 1 (which deliberately makes no distinction between the tablet or the syrup form of the compound, since no clear distinction in efficacy appeared) shows that the preparation appears effective as a means of reducing or stopping dry coughs, and of reducing the annoying frequency of moist coughs.

All-in-all, 88 per cent of the patients experienced relief; 76 of these patients defined the relief as excellent. The relief obtained by those with moist coughs proved slightly better than that obtained by those with dry coughs. There were no side-effects—no drowsiness or constipation—except nausea, which was reported by six patients.

DISCUSSION.

An evaluation of any antitussive agent is extremely difficult, complicated as it is by psychologic factors, by the self-limiting nature of coughs, by the unpredictability of their appearance or disappearance; however, pharmacodynamic data that demonstrate the ability of a compound to suppress artificially-induced coughs may be considered to be at least presumptive evidence of potential clinical usefulness. An analysis of the failures, and of those cases in which the medication was but fairly effective, reveals several facts. Four of the six patients who reported no relief had dry, hacking coughs that had persisted from one to three months before taking the medication, despite the fact that all of these four had tried several preparations, with and without our advice. The same history of long, repeated failure to obtain relief from dry, paroxysmal coughing was shared by several of the eight patients in whom the medication had proved but fairly effective; however, no rigid correlation could be drawn between long-standing, dry coughs and the failure of the preparation, for eight patients whose dry coughs had persisted for more than a month (for five months, in two cases) obtained excellent relief. It can only be concluded—and this conclusion is well known to all practitioners—that the chronic, dry, cough is an intractable condition that may or may not yield to the action of a particular antitussive agent.

No drowsiness that could be attributed to the medication was noted, nor were there any toxic effects in the 490 patient-days that this evaluation represents. As has been mentioned, mild nausea was the only effect encountered, and it occurred only in those patients who took the syrup form. It appeared to be related to the taste of the vehicle. Interestingly enough, none of the 14 children who took the syrup experienced nausea.

SUMMARY.

Caramiphen ethane disulfonate, an anticholinergic compound, has been evaluated clinically as an antitussive agent. Taken in syrup or tablet form to relieve dry or moist, usually

unproductive coughs associated with eight conditions in 100 patients, it proved excellent in 76, fairly effective in 12, ineffective in six. The remaining six patients experienced mild nausea. No drowsiness, constipation, or other side effects were noted.

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HEARING AIDS ACCEPTED BY THE COUNCIL ON PHYSICAL MEDICINE OF THE AMERICAN MEDICAL ASSOCIATION.

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Acousticon Models A-17 and A-185.
Manufacturer: Dictograph Products, Inc., 95-25 149th St., Jamaica 1, New York.

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Manufacturer: National Earphone Co., Inc., 20-22 Shipman St., Newark 2, N. J.

Auditone Models 11 and 15.
Manufacturer: Audio Co. of America, 5305 N. Sixth St., Phoenix, Ariz.

Audivox Model Super 67 and 70.
Manufacturer: Audivox, Inc., 259 W. 14th St., New York 11, N. Y.

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Manufacturer: Aurex Corp., 1117 N. Franklin St., Chicago, Ill.

Beltone Symphonette; Beltone Mono-Pac Model M; Mono-Pac Model "Lyric"; Mono-Pac Model "Rhapsody."
Manufacturer: Beltone Hearing Aid Co., 1450 W. 19th St., Chicago, Ill.

Cleartone Model 500; Model 700; Cleartone Regency Model.
Manufacturer: American Sound Products, Inc., 1303 S. Michigan Ave., Chicago 5, Ill.

Dahlberg Model D-1; Dahlberg Junior Model D-2; Dahlberg Model D-3 Tru-Sonic; Dahlberg Model D-4 Tru-Sonic.
Manufacturer: The Dahlberg Co., Golden Valley, Minneapolis 22, Minn.

Fortiphone Models 19-LR; 20A; 21-C and 22.
Manufacturer: Fortiphone Limited, Fortiphone House, 247 Regent St., London W. 1, England.
Distributor: Anton Heilman, 75 Madison Ave., New York 16, N. Y.

Gem Hearing Aid Model V-35; Gem Model V-60.
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Goldentone Models 25, 69 and 97.

Manufacturer: Johnston Hearing Aid Mfg. Co., 708 W. 40th St., Minneapolis 8, Minn.

Distributor: Goldentone Corp., 708 W. 40th St., Minneapolis 8, Minn.

Maico UE-Atomeer; Maico Quiet Ear Models G and H; Maico Model J; Maico Top Secret Model L.

Manufacturer: Maico Co., Inc., 21 North Third St., Minneapolis, Minn.

Mears (Crystal and Magnetic) Aurophone Model 200.

Manufacturer: Mears Radio Hearing Device Corp., 1 W. 34th St., New York, N. Y.

Micronic Model 303; Micronic Model "Mercury"; Micronic Star Model.

Manufacturer: Audivox, Inc., Successor to Western Electric Hearing Aid Division, 123 Worcester St., Boston 18, Mass.

Microtone Classic Model T9; Microtone Model T10; Microtone Model T612; Microtone Model 45.

Manufacturer: Microtone Co., Ford Parkway on the Mississippi, St. Paul, Minn.; Minneapolis 9, Minn.

National Model D (Duplex); National Standard Model T; National Star Model S; National Ultrathin Model 504; National Vanity Model 506.

Manufacturer: National Hearing Aid Laboratories, 815 S. Hill St., Los Angeles 14, Calif.

Normatone Model C.

Manufacturer: Johnston Hearing Aid Mfg. Co., 708 W. 40 St., Minneapolis, Minn.

Distributor: Normatone Hearing Aid Co., 22 East 7th St., St. Paul (1), Minn.

Otarion Model E-4; Otarion Models F-1, F-2 and F-3; Otarion Model G-2; Otarion Model G-3; Otarion Model H-1; Custom 5.

Manufacturer: Otarion Hearing Aids, 4757 N. Ravenwood, Chicago 40. Ill.

Paravox Model D, "Top-Twin-Tone"; Model J (Tiny-Mite); Paravox Model Y (YM, YC and YC-7) (Veri-Small).

Manufacturer: Paravox, Inc., 2056 E. 4th St., Cleveland, Ohio.

Radioear Permo-Magnetic Multipower; Radioear All Magnetic Model 55; Radioear Model 62 Starlet; Model 72; Model 82 (Zephyr).

Manufacturer: E. A. Myers & Sons, 306 Beverly Rd., Mt. Lebanon, Pittsburgh, Pa.

Distributor: Radioear Corp., 306 Beverly Rd., Mt. Lebanon, Pa.

Silvertone Model J-92; Silvertone Model P-15.

Manufacturer: W. E. Johnson Mfg. Co., 708 W. 40th St., Minneapolis, Minn.

Distributor: Sears, Roebuck & Co., 925 S. Homan Ave., Chicago 7, Ill.

Solo-Pak Model 99.

Manufacturer: Solo-Pak Electronics Corp., Linden St., Reading, Mass.

Sonotone Model 900; Sonotone Models 910 and 920; Sonotone Model 925; Sonotone Model 940; Sonotone Model 966; Sonotone Model 977; Sonotone Model 988 and Sonotone Model 1010.

Manufacturer: Sonotone Corp., Elmsford, N. Y.

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Manufacturer: Telex, Inc., Telex Park, St. Paul 1, Minn.

Tonamic Model 50.

Manufacturer: Tonamic, Inc., 12 Russell St., Everett 49, Mass.

Tonemaster; Model Cameo.

Manufacturer: Tonemasters, Inc., 406 S. Washington St., Peoria 2, Ill

Unex Midget Model 95; Unex Midget Model 110; Unex Models 200 and 230.
Manufacturer: Nichols & Clark, Hathorne, Mass.

Vacolite Models J and J-2.
Manufacturer: Vacolite Co., 3003 N. Henderson St., Dallas 6, Tex.

Zenith Miniature 75; Zenith Model Royal; Zenith Model Super Royal; Zenith "Regent."
Manufacturer: Zenith Radio Corp., 6001 Dickens Ave., Chicago, Ill.

All of the accepted hearing devices employ vacuum tubes.

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TABLE HEARING AIDS.

Ambco Hearing Amplifier (Table Model).
Manufacturer: A. M. Brooks Co., 1222 W. Washington Blvd., Los Angeles 7, Calif.

Aurex (Semi-Portable).
Manufacturer: Aurex Corp., 1117 N. Franklin St., Chicago 10, Ill.

Precision Table Hearing Aid.
Manufacturer: Precision Hearing Aids, 5157 W. Grand Ave., Chicago 39, Ill.

Sonotone Professional Table Set Model 50.
Manufacturer: Sonotone Corp., Elmsford, N. Y.

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Meeting: Waldorf-Astoria, New York City, Sept., 1954.

PAN AMERICAN ASSOCIATION OF OTO-RHINO-LARYNGOLOGY AND BRONCHO-ESOPHAGOLOGY.

President: Dr. Justo M. Alonso, Montevideo.
Executive Secretary: Dr. Chevalier L. Jackson, 1901 Walnut St., Philadelphia 3, Pa., U. S. A.
Meeting: Fourth Pan American Congress of Oto-Rhino-Laryngology and Broncho-Esophagology.
President: Dr. Ricardo Tapia Acuna, Mexico City.
Time and Place: Feb. 28 to Mar. 4, 1954, Mexico City.

MISSISSIPPI VALLEY MEDICAL SOCIETY.

President: Dr. Daniel L. Sexton, St. Louis, Mo.
President-Elect: Dr. John I. Marker, Davenport, Iowa.
Secretary-Treasurer: Dr. Harold Swanberg, Quincy, Ill.
Assistant Secretary-Treasurer: Dr. Jacob E. Reisch, Springfield, Ill.
Meeting:

THE VIRGINIA SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY.

President: Dr. Peter N Pastore, Richmond, Va.
President-Elect: Dr. G. S. Fitz-Hugh, Charlottesville, Va.
Vice-President: Dr. H. L. Mitchell, Lexington, Va.
Secretary-Treasurer: Dr. L. B. Sheppard, 301 Medical Arts Bldg., Richmond, Va.

LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY.

President: Orwyn H. Ellis, M.D.
Secretary-Treasurer: Harold Owens, M.D.
Chairman of Section on Ophthalmology: Robert A. Norene, M.D.
Secretary of Section on Ophthalmology: Sol Rome, M.D.
Chairman of Section on Otolaryngology: Leland R. House, M.D.
Secretary of Section on Otolaryngology: Max E. Pohlman, M.D.
Place: Los Angeles County Medical Association Bldg., 1925 Wilshire Blvd., Los Angeles, Calif.
Time: 6:00 P.M., fourth Monday of each month from September to June, inclusive—Otolaryngology Section; 6:00 P.M., first Thursday of each month from September to June, inclusive—Ophthalmology Section.

AMERICAN OTORHINOLOGIC SOCIETY FOR THE ADVANCEMENT OF PLASTIC AND RECONSTRUCTIVE SURGERY.

President: Dr. Harry Nievert, 555 Park Ave., New York (21), N. Y.
Secretary: Dr. Louis Joel Fleit, 66 Park Ave., New York (16), N. Y.

NORTH CAROLINA EYE, EAR, NOSE AND THROAT SOCIETY.

President: Dr. William Banks Anderson, Durham, N. Car.
Secretary and Treasurer: Dr. Geo. B. Ferguson, Durham, N. Car.
Meeting:

SOUTH CAROLINA SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. Clay W. Evatt, Charleston, S. Car.
Vice-President: Dr. David S. Asbill, Columbia, S. Car.
Secretary-Treasurer: Dr. Roderick Macdonald, Rock Hill, S. Car.
Meeting:

PACIFIC COAST OTO-OPHTHALMOLOGICAL SOCIETY.

President: Dr. Leland G. Hunnicutt, 98 N. Madison Ave., Pasadena, Calif.
Secretary-Treasurer: Dr. John F. Tolan, 3419 47th Ave., Seattle (5), Wash.
Meeting: Honolulu, 1954.

THE RESEARCH STUDY CLUB OF LOS ANGELES, INC.

Chairman: Dr. Isaac H. Jones, 635 S. Westlake, Los Angeles, Calif.
Treasurer: Dr. Pierre Violé, 1930 Wilshire Blvd., Los Angeles, Calif.
Program Chairmen:
Otolaryngology: Dr. Leland G. Hunnicutt, 98 N. Madison Ave., Pasadena, Calif.
Ophthalmology: Dr. Harold F. Whalman, 727 W. 7th St., Los Angeles, Calif.
Mid-Winter Clinical Convention annually the last two weeks in January at Los Angeles, Calif.

FLORIDA SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY.

President: Dr. Chas. C. Grace, 145 King St., St. Augustine, Fla.
President-Elect: Dr. Jos. W. Taylor, 706 Franklin St., Tampa, Fla.
Secretary-Treasurer: Dr. Carl S. McLemore, 1217 Kuhl Ave., Orlando, Fla.

THE PHILADELPHIA LARYNGOLOGICAL SOCIETY.

President: Dr. Harry P. Schenck.
Vice-President: Dr. William J. Hitschler.
Treasurer: Dr. Chevalier L. Jackson.
Secretary: Dr. John J. O'Keefe.
Historian: Dr. Herman B. Cohen.
Executive Committee: Dr. M. Valentine Miller, Dr. Charles E. Towson, Dr. Thomas F. Furlong, Dr. Benjamin H. Shuster, ex-officio.

SOUTHERN MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY.

Chairman: Dr. Edley H. Jones, 1301 Washington St., Vicksburg, Miss.
Vice-Chairman: Dr. K. W. Cosgrove, 111 E. Capitol Ave., Little Rock, Ark.
Secretary: Dr. F. A. Holden, Medical Arts Bldg., Baltimore, Md.
Meeting:

WEST VIRGINIA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY.

President: Dr. James K. Stewart, Wheeling, W. Va.
Secretary-Treasurer: Dr. Frederick C. Reel, Charleston, W. Va.

CENTRAL ILLINOIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY.

President: Dr. G. C. Otrich, Belleville, Ill.
President-Elect: Dr. Phil R. McGrath, Peoria, Ill.
Secretary-Treasurer: Dr. Alfred G. Schultz, Jacksonville, Ill.

CANADIAN OTOLARYNGOLOGICAL SOCIETY SOCIETE CANADIENNE D'OTOLARYNGOLOGIE

President: Dr. D. E. S. Wishart, 170 St. George St., Toronto, Ontario.
Secretary: Dr. W. Ross Wright, 361 Regent St., Fredericton, N. B.
Place:
Time:

SOCIEDAD DE OTO-RINO-LARINGOLOGIA, COLEGIO MEDICO DE EL SALVADOR, SAN SALVADOR, C. A.

President: Dr. Salvador Mixco Pinto.
Secretary: Dr. Daniel Alfredo Alfaro.
Treasurer: Dr. Antonio Pineda M.

MEXICAN ASSOCIATION OF PLASTIC SURGEONS.

President: Dr. Cesar LaBoide, Mexico, D. F.
Vice-President: Dr. M. Gonzalez Ulloa, Mexico, D. F.
Secretary: Dr. Juan de Dios Peza, Mexico, D. F.

FEDERACION ARGENTINA, DE SOCIEDADES DE OTORRINOLARINGOLOGIA.

Secretario del Exterior: Dr. Juan Manuel Tato.
Sub-Secretario del Exterior: Dr. Oreste E. Bergaglio.
Secretario del Interior: Dr. Eduardo Casterán.
Sub-Secretario del Interior: Dr.Atilio Viale del Carril.
Secretario Tesorero: Dr. Vicente Carri.
Sub-Secretario Tesorero: Dr. José D. Suberviola.

ASOCIACION DE OTO-RINO-LARINGOLOGIA DE BARCELONA, SPAIN.

Presidente: Dr. J. Abello.
Vice-Presdente: Dr. Luis Suñe Medan.
Secretario: Dr. Jorge Perelló, 319 Provenza, Barcelona.
Vice-Secretario: Dr. A. Pinart.
Vocal: Dr. J. M. Ferrando.

SOCIEDAD NACIONAL DE CIRUGIA OF CUBA.

Presidente: Dr. Reinaldo de Villiers.
Vicepresidente: Dr. César Cabrera Calderin.
Secretario: Dr. José Xirau.
Tesorero: Dr. Alfredo M. Petit.
Vocal: Dr. José Gross.
Vocal: Dr. Pedro Hernández Gonzalo.

INTERNATIONAL BRONCHOESOPHAGOLOGICAL SOCIETY.

President: Dr. Andre Soulas, Paris, France.
Secretary: Dr. Chevalier L. Jackson, 1901 Walnut St., Philadelphia 3, Pa. U. S. A.
Meeting: 3rd International Congress of Broncho-Esophagology.
Time and Place: September or October, 1954, Lisbon, Portugal.

ASSOCIACAO MEDICA DO INSTITUTO PENIDO BURNIER — CAMPINAS.

President: Dr. Heitor Nascimento.
First Secretary: Dr. Roberto Barbosa.
Second Secretary: Dr. Roberto Franco do Amaral.
Librarian-Treasurer: Dr. Leoncio de Souza Queiroz.
Editors for the Archives of the Society: Dr. Guedes de Melo Filho, Dr. Penido Burnier and Dr. Gabriel Porto.

SOCIEDAD DE OTORRINOLARINGOLOGIA Y BRONCOESOFAGOSCOPIA DE CORDOBA.

Presidente: Dr. Aldo Remorino.
Vice-Presidente: Dr. Luis E. Olsen.
Secretario: Dr. Eugenio Romero Diaz.
Tesorero: Dr. Juan Manuel Pradales.
Vocales: Dr. Osvaldo Suárez, Dr. Nondier Asis R., Dr. Jorge Bergallo Yofre.

BUENOS AIRES CLUB OTORINOLARINGOLOGICO.

Presidente: Dr. Alberto P. Haedo.
Vice-Presidente: Dr. V. R. Carri.
Secretario: Dr. Renoto Segre.
Pro-Secretario: Dr. Carlos A. Gutierrez.
Tesorero: Dr. J. M. Tato.
Pro-Tesorero: Dr. Norberto Von Soubiron.

SOCIEDAD COLOMBIANA DE OFTALMOLOGIA Y OTORRINOLARINGOLOGIA (BOGOTA, COLOMBIA).

Presidente: Dr. Alfonso Tribin P.
Secretario: Dr. Felix E. Lozano.
Tesorero: Dr. Mario Arenas A.

SOCIEDAD ESPANOLA DE OTORRINOLARINGOLOGIA.

Presidente: Dr. D. Adolfo Hinojar Pons.
Vice-Presidente: Dr. D. Jose Perez Mateos.
Secretario General: Dr. D. Francisco Marañés.
Tesorero: Dr. D. Ernesto Alonso Ferrer.

ASOCIACION DE OTORRINOLARINGOLOGIA Y BRONCOESOFAGOLOGIA DE GUATEMALA

Presidente: Dr. Julio Quevedo, 15 Calle Oriente No. 5.
First Vice-Presidente: Dr. Héctor Cruz, 3a Avenida Sur No. 72.
Second Vice-Presidente: Dr. José Luis Escamilla, 5a Calle Poniente No. 48.
Secretario-Tesorero: Dr. Horace Polanco, 13 Calle Poniente No. 9-D.

FIRST CENTRAL AMERICAN CONGRESS OF OTORHINOLARYNGOLOGY.

President: Dr. Victor M. Noubleau, San Salvador.
Secretary-Treasurer: Dr. Hector R. Silva, Calle Arce No. 84, San Salvador, El Salvador, Central America.

THIRD LATIN-AMERICAN CONGRESS OF OTORINOLARINGOLOGIA.

President: Dr. Franze Conde Jahn, Caracas.
Secretary: Dr. Victorino Marquez Reveron, Caracas.
Meeting: Caracas, Venezuela, Feb. 21-25, 1954.

THE AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC.

The following is a schedule of 1954 Meetings:

Eastern Section	Fri., Jan. 8th	New York City	The Waldorf-Astoria
Council Meeting	Sat., Jan. 9th	New York City	The Waldorf-Astoria
Southern Section	Sat., Jan. 16th	Louisville, Ky.	Brown Hotel
Middle Section	Mon., Jan. 18th	St. Louis, Mo.	Park Plaza Hotel
Western Section	Sat., Feb. 16th	Portland, Ore.	University Oregon Medical School

('In Portland, room reservations may be made at the Heathman Hotels.)

ANNUAL MEETING, Tues.-Thurs., May 25-27
Boston, Mass., Hotel Statler

May we call your attention to some of the attractions of Boston: Scene of the "Boston Tea Party" and the Battle of Bunker Hill; site of Faneuil Hall, the "Cradle of Liberty"; and the Old North Church (from the steeple of which the signal was given to Paul Revere); residences of Henry Wadsworth Longfellow, Wendell Phillips and William Lloyd Garrison; a short ride to the battle fields of Concord and Lexington, and the homes of the Alcotts, Emerson, Hawthorne and Thoreau; the birthplace of the Christian Science and Unitarian movements; and for those more interested in matters at hand, Durgin-Park for excellent food in a public market atmosphere; also the Boston Pops Orchestra for enjoyable music.

Reservations at the Boston Statler may be made by addressing Mr. Fred W. Potts, Sales Manager of the hotel.

For further information contact C. Stewart Nash, M.D., Secretary, 708 Medical Arts Bldg., Rochester (7), N. Y.

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